U.S. DEPARTMENT OF COMMERCE
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PROCEEDINGS OF ENVIRONMENTAL IMPACT STATEMENT CONFERENCE, HELD AT KANSAS CITY, MISSOURI ON 8-9 NOVEMBER 1972

ENVIRONMENTAL PROTECTION AGENCY

NOVEMBER 1972

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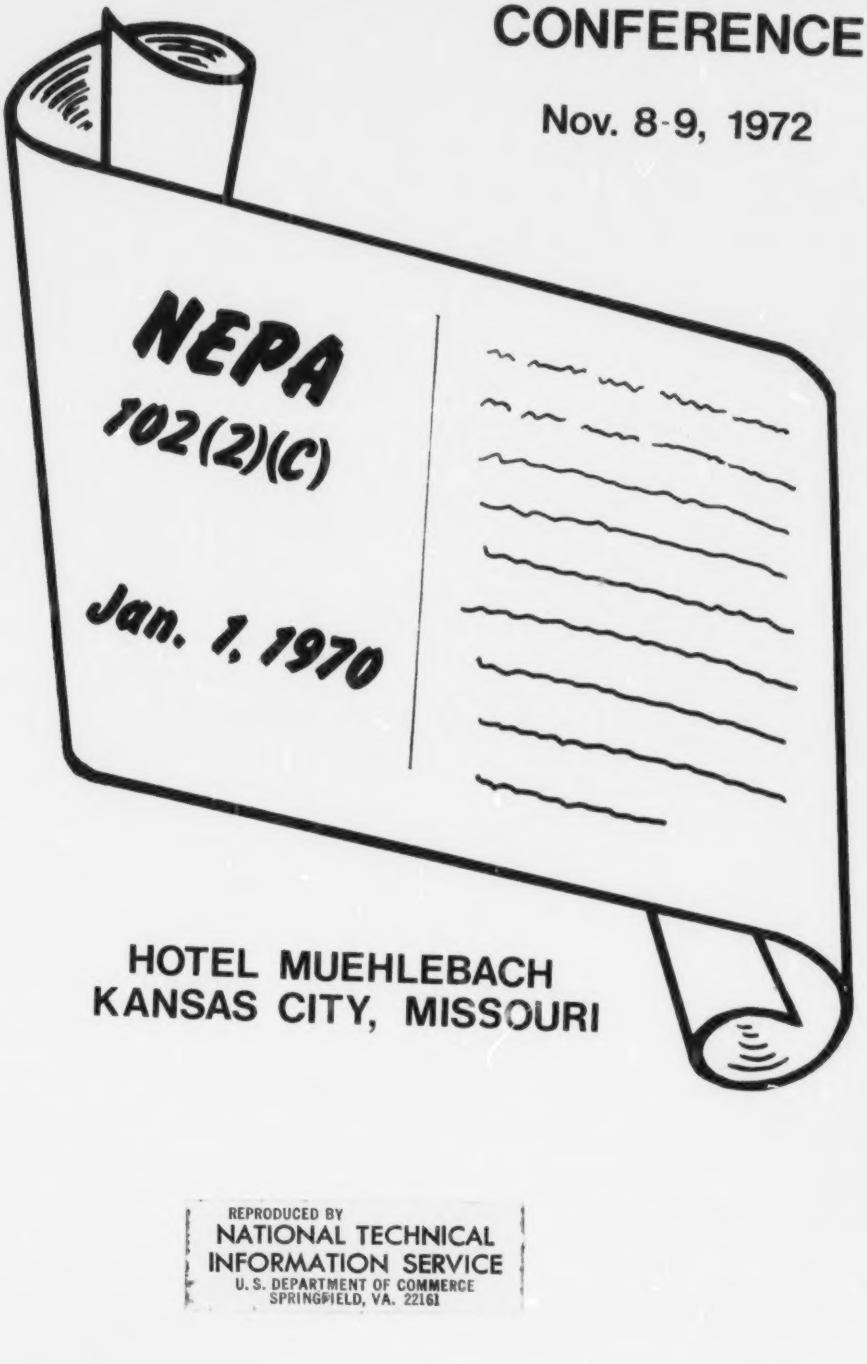
ENVIRONMENTAL IMPACT STATEMENT CONFERENCE

Nov. 8-9, 1972



HOTEL MUEHLEBACH
KANSAS CITY, MISSOURI

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c. Water Resources Projects – J. J. Cassidy, Professor
and Chairman
Civil Engineering Department
University of Missouri–Columbia
Columbia, Missouri

1. Dams and Reservoirs
2. Irrigation Systems

d. Transportation – R. R. Waesche, Rear Admiral, USCG (Ret.)
Secretarial Representative
U.S. Department of Transportation
Kansas City, Missouri

1. Roads and Bridges
Bernard A. Halver, Regional Landscape Architect
Federal Highway Administration
Kansas City, Missouri
2. Terminals and Airports
Benjamin H. Morrow, Environmental Specialist
Federal Aviation Administration

4:00 SUMMARY AND CONCLUSIONS
Lou Hemphill, Conference Chairman
Associate Professor, Civil Engineering Department
University of Missouri–Columbia
Columbia, Missouri

University of Missouri --
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GENERAL INFORMATION

LOCATION: All sessions of the conference will be held at the Hotel Muehlebach located at 12th and Wyandotte Streets, Kansas City, Missouri.

REGISTRATION: You may register by filling out the attached registration form and mailing it with your check, made payable to the University of Missouri, to: Conferences and Short Courses, ATTN: Environmental Impact Statement, 344 Hearnes Multipurpose Building, University of Missouri, Columbia, Missouri 65201. Please Pre-register.

FEE: The fee for the conference is $15.00. This includes the cost of conference materials, two luncheons, and the banquet.

HOUSING: If you wish to stay at the Hotel Muehlebach, you should write: Hotel Muehlebach, 12th and Wyandotte Streets, Kansas City, Missouri 64105 or call 816-471-1400. Please indicate you are with the Environmental Impact Statement Conference when making your reservation.

COORDINATOR: Your coordinator for the conference is Franklin W. Figg. You may contact him by writing to Conferences and Short Courses, 344 Hearnes Multipurpose Building, University of Missouri, Columbia, Missouri 65201 or by calling 314-882-3066.

SPONSORS:
Environmental Protection Agency, Region VII

Environmental Quality Committee of the
Federal Executive Board of Greater Kansas City

College of Engineering

The University Extension Division
University of Missouri–Columbia

REGION VII

Environmental Impact Statement Conference

NOVEMBER 8-9, 1972

Kansas City, Missouri **Hotel Muehlebach**

THE ENVIRONMENTAL IMPACT STATEMENT

November 8-9, 1972 Kansas City, Missouri

Wednesday, November 8, 1972

AM
8:00 REGISTRATION
Muehlebach Hotel
Kansas City, Missouri

8:45 WELCOME ADDRESS
Jerome H. Svore, Regional Administrator
Environmental Protection Agency
Kansas City, Missouri

9:00 ORIGIN, LEGAL HISTORY AND IMPLEMENTATION OF THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969
David R. Tripp, Assistant Regional Counsel
Environmental Protection Agency
Kansas City, Missouri

10:00 COFFEE AND CONVERSATION BREAK

10:30 CONSERVATIONIST'S ATTITUDES ABOUT ENVIRONMENTAL IMPACT STATEMENTS
Bill Crawford, Superintendent of Game Research
Missouri Conservation Commission
Columbia, Missouri

11:15 PRESENT STATUS AND PROBLEMS
Edward C. Vest, Environmental Impact Statement Coordinator
Environmental Protection Agency
Kansas City, Missouri

PM
12:00 LUNCHEON - RESEARCH, EDUCATION, AND THE ENVIRONMENT
A. H. Emmons, Vice-President for Research
University of Missouri-Columbia
Columbia, Missouri

1:00 ENVIRONMENTAL IMPACT STATEMENTS AND THE ECOLOGIST
Darrell L. King, Professor of Civil Engineering
University of Missouri-Columbia
Columbia, Missouri

2:00 PRESENT PRACTICE AND CURRENT METHODOLOGIES FOR PREPARING ENVIRONMENTAL IMPACT STATEMENTS
Edward G. Struxness
Oak Ridge National Laboratory

3:30 COFFEE BREAK

4:00 INDUSTRY AND THE ENVIRONMENTAL IMPACT STATEMENT
a. Construction Industries
Hugo Simens, Bechtel Corporation
San Francisco, California

b. Power Industries
Daniel M. Hall, Assistant General Counsel and Assistant Secretary for Peabody Coal Company
St. Louis, Missouri

c. Transportation Industries
R. R. Waesche, Rear Admiral, USCG (Ret.)
Secretarial Representative
U.S. Department of Transportation
Kansas City, Missouri

d. Chemical Industries
Jack Garrett, Monsanto Chemical Company
St. Louis, Missouri

5:00 ADJOURN

6:30 SOCIAL HOUR AND DINNER

8:00 "ENGINEERING EDUCATION: PREPARATION FOR THE ENVIRONMENT"
William R. Kimel, Dean of Engineering
University of Missouri-Columbia
Columbia, Missouri

Thursday, November 9, 1972

AM
8:30 POWER REACTORS AND THE ENVIRONMENTAL IMPACT STATEMENT
Speakers to be from:
a. Public Utility
Eric N. Sloth, Environmental Manager
Nebraska Public Power District
Columbus, Nebraska

b. Fossil Fuel Plant
Einar Swanson, Black and Veatch Consulting Engineers
Kansas City, Missouri

c. Nuclear Reactors
Morton I. Goldman, Vice-President and General Manager
NUS Corporation Environmental Safeguards Division
Rockville, Maryland

9:55 BREAK

10:10 WATER MANAGEMENT PROJECTS AND THE E.I.S.
a. Army Corps of Engineers
Lewis G. Helm, Chief of Environmental Resources Section
U.S. Army Corps of Engineers
Kansas City, Missouri

b. Bureau of Reclamation
George Talbott, Civil Engineer
Division of Planning and Coordination
U.S. Bureau of Reclamation
Denver, Colorado

c. U.S. Department of Agriculture, Soil Conservation Service
Wade H. Hamor, Regional Biologist
U.S. Department of Agriculture
Lincoln, Nebraska

11:30 ENVIRONMENTAL IMPACT STATEMENTS AND THE CONSULTING ENGINEER
William L. Smith, Planning Engineer
Van Doren, Hazard, Stallings, and Schnacke Engineers
Topeka, Kansas

PM
12:00 LUNCH
Luncheon Address: "Design for the Environment"
Gerald McLindon, Dean
School of Environmental Design
Louisiana State University
Baton Rouge, Louisiana

1:15 WORKSHOP SESSIONS
a. Power - Edwin L. Cox, Director
Research Reactor Facility
University of Missouri-Columbia
Columbia, Missouri

1. Fossil Fuel
2. Nuclear Reactors
3. Hydro Power

b. Municipal Utilities - J. T. Novak, Associate Professor
Civil Engineering Department
University of Missouri-Columbia
Columbia, Missouri
and
James K. Edzwald, Assistant Professor
Civil Engineering Department
University of Missouri-Columbia
Columbia, Missouri

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INTRODUCTION

The National Environmental Policy Act of 1969 was signed into law as PL 91-190 by President Richard Nixon on January 1, 1970. Since its passage, all Federal agencies have been required to assess their projects or actions for a determination of significant effects on the quality of the human environment. The law, Section 102(2)(c), states the responsible Federal official must prepare a detailed Environmental Impact Statement for any project or action having a significant effect on the quality of the human environment. This impact statement should include:

1. The environmental impact of the proposed action,

2. any adverse environmental effects which cannot be avoided should the proposal be implemented,

3. alternatives to the proposed action,

4. the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and

5. any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Not only has the burden for preparation of the Environmental Impact Statement been placed on Federal agencies, it has also affected state and local governments, consulting engineering companies, environmental organizations, and the general public. In many cases, the responsibility for the environmental assessment has been delegated to the state or local authorities who, in turn, ask their consultants to do the work.

The great number of lawsuits filed against responsible Federal agencies by environmental groups or individuals has proven that the law must be followed. Most of the cases have been on the grounds that either an Environmental Impact Statement was not prepared or that the impact statement was not complete.

These considerations led the University of Missouri at Columbia and the U.S. Environmental Protection Agency, Region VII, to sponsor a conference on Environmental Impact Statements which was held November 8 and 9, 1972, at the Hotel Muehlebach in Kansas City, Missouri. Attendance was excellent with over 300 paid registrations.

These proceedings include the papers presented by all speakers (with the exception of four papers which were not received) who participated in the Environmental Impact Statement Conference.

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ORIGIN, LEGAL HISTORY AND IMPLEMENTATION
OF THE
NATIONAL ENVIRONMENTAL POLICY ACT OF 1969

By

DAVID R. TRIPP

ASSISTANT REGIONAL COUNSEL
REGION VII - ENVIRONMENTAL PROTECTION AGENCY
KANSAS CITY, MISSOURI

Ancestry of the National Environmental Policy Act

(Hereinafter Referred to as "NEPA")

The Federal Power Act, 16 USC 803, was the first legislative mandate to a federal agency to consider the "beneficial public uses, including recreational purposes, of its water or power producing projects." Two landmark court decisions interpreted this statute as imposing an affirmative duty on the Federal Power Commission to consider and investigate any adverse environmental impacts of each project. The first case, Scenic Hudson v. FPC, 354 F. 2d 608, 1 ERC 1084, involved an area popularly known as the Storm King Mountain, which would have been partially inundated by an FPC-licensed project. The court remanded the case to the Commission for further proceedings and stated that "the Commission's renewed proceedings must include as a basic concern the preservation of natural beauty and of national historic shrines, keeping in mind that, in our affluent society, the cost of a project is only one of several factors to be considered. The record as it comes to us fails markedly to make out a case for the Storm King project on, among other matters, costs, public convenience and necessity, and absence of reasonable alternatives. Of course, the Commission should make every effort to expedite the new proceedings."

In the second case, Udall v. FPC, 387 US 428, 1 ERC 1069, the Supreme Court dealt with another proposed reservoir project, and held that a full consideration of the alternatives to the project must be given, including the use of nuclear power sources or any other reasonable alternative. The court further required that the FPC should consider the impact of the proposed project on wildlife and fish conservation, as well as the public interest in preserving the rivers and wilderness areas to be affected.

The other legislative ancestors of NEPA were the Department of Transportation Act, the Fish and Wildlife Coordination Act, and the National Historic Preservation Act. These Acts formalized the demand for a consideration of alternatives, and introduced the requirement that the "lead" agency must consult with other agencies having expertise in the areas which are to be affected by the project.

Legislative History of NEPA

NEPA was introduced in the House of Representatives on February 17, 1969. The debate surrounding the bill centered on governmental impact on man's environment. Witnesses testified to "the manner in which Federal policies and activities have contributed to environmental decay and degradation." The Act itself was patterned after the Employment Act of 1946, in that it set up a council, required an annual report to the President, and declared a federal responsibility to act upon a problem. The Act passed both Houses of Congress, and was made effective on January 1, 1970, as Public Law 91-190, and is codified at 42 USC 4321 et seq. First, it established a policy (Section 101(a)):

> "The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans."

Secondly, the Act established a responsibility (Sections 101(b) and 101(c)):

> "(b) In order to carry out the policy set forth in this act, it is the continuing responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may--

> (1) Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
>
> (2) Assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;
>
> (3) Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
>
> (4) Preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice;
>
> (5) Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
>
> (6) Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

> "(c) The Congress recognizes that each person should enjoy a healthful environment and that each person has a responsibility to contribute to the preservation and enhancement of the environment."

And finally, it provided an action mechanism for fulfilling the responsibility (Section 102(C)):

> "Include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on--
>
> (i) The environmental impact of the proposed action,
>
> (ii) Any adverse environmental effects which cannot be avoided should the proposal be implemented,

(iii) Alternatives to the proposed action,

(iv) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and

(v) Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Prior to making any detailed statement, the responsible Federal official shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved. Copies of such statement and the comments and views of the appropriate Federal, State, and local agencies, which are authorized to develop and enforce environmental standards, shall be made available to the President, the Council on Environmental Quality and to the public as provided by section 552 of title 5, United States Code, and shall accompany the proposal through the existing agency review processes;"

The Impact of NEPA on Federal Agencies

The federal policy established under Sections 101(a) and (b) previously referred to may be paraphrased as a mandate to all federal agencies to "protect and enhance the environment."

Section 102(1) directs that this policy shall be followed to the fullest extent possible, and that "the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act . . . ."

Two cases quickly established the stature of NEPA by holding that compliance with the Act was mandatory, unless the express provisions of another statute made compliance impossible. In Ely v. Velde, 451 F. 2d 1130, 3 ERC 1280, the United States District Court of Appeals held that compliance with NEPA was not excused by a provision of the Law Enforcement Assistance Administration Act under which a grant was given to the State of Virginia for the purpose of building a prison. The Law Enforcement Assistance Administration argued that building a prison was an activity subject solely to the requirements of the Safe Streets Act and since the Safe Streets Act made no mention of NEPA, environmental considerations were irrelevant. The court denied this narrow construction and stated in its conclusion that a consistent reading of the two statutes could be reached by "observing the common sense duty, in the absence of irreconcilable conflict, to dovetail this statute with others."

The second case which questioned the stature of NEPA was Calvert Cliffs Coordinating Committee v. AEC, 449 F. 2d 1109, 2 ERC 1779. This case held that the Atomic Energy Commission's blanket policy against considering any environmental effects of its licenses or proprietary activities if there was a state certification of compliance with water quality standards violated NEPA, since any action that might cause environmental damage must be considered by the agency which itself licenses or conducts the activity. The court found it necessary for the agency's own assessment of environmental impact to accompany the application for license through the review process, and said of the AEC's belief that assessment of environmental effects could be adequately performed by the applicant outside of the hearing process:

> "We believe that the Commission's crabbed interpretation of NEPA makes a mockery of the Act. What possible purpose could there be in the Section 102(2)(C) requirement (that the 'detailed statement' accompany proposals through agency review processes) if 'accompany' means no more than physical proximity . . .? What possible purpose could there be in requiring the 'detailed statement' to be before hearing boards, if the boards are free to ignore entirely the contents of the statement? NEPA was meant to do more than regulate the flow of papers in the federal bureaucracy. The word 'accompany' in Section 102(2)(C) must not be read so narrowly as to make the Act ludicrous. It must, rather, be read to indicate a congressional intent that environmental factors, as compiled in the 'detailed statement,' be considered through agency review processes."
>
> ". . .[The Commission] must itself take the initiative of considering environmental values at every distinctive and comprehensive stage of the process beyond the staff's evaluation and recommendation."

As suggested by Calvert Cliffs, the effect of NEPA on federal agencies is further carried out by Section 102(2)(B), which requires all agencies to establish procedures by which they shall give environmental values appropriate consideration in their decision-making.

Section 103 of NEPA requires all agencies to review their statutory authority, administrative regulations, policies and procedures, and to propose to the President such measures as may be necessary to bring their authority into conformity with NEPA.

Sections 104 and 105 provide that nothing in the Act shall be construed to relieve any agency of its obligation to comply with specific environmental standards, and that NEPA shall be considered supplemental to any other environmental considerations.

Several cases stand for the proposition that consideration of NEPA elements must begin at the earliest possible stage in the decision-making process. Zabel v. Tabb, 430 F. 2d 199, 1 ERC 1449, is representative of these cases. In essence, it requires that the Government must consider environmental factors at the earliest possible stage in the decision-making process, including consultation with agencies having environmental expertise, and refrain from the activity where the project is found to be not in the public interest. A more recent case which found the same conclusion was Committee to Stop Route 7 v. Volpe, 4 ERC 1329. The defendant Volpe, Secretary of Transportation, argued that consideration of environmental effects by the State of Connecticut made federal reconsideration unnecessary. The court said, "It would be administrative legerdemain to permit NEPA to be deemed inapplicable to these projects because decision-making that occurred when NEPA was in effect might have been but was not taken at an earlier time when NEPA was not in effect . . . ."

The foregoing sections and the cases dealing with them make it obvious that NEPA applies most directly to projects which are being administered by the Federal Government.

However, the impact upon the Government has not been solely upon its own projects. NEPA has been found to apply to regulatory functions as well as to the proprietary activities of federal agencies. With Calvert Cliffs (supra) as the forerunner, a host of cases began to require the application of NEPA to the regulatory, licensing and permit functions of administrative agencies. A few examples of the types of activities which have been found to require a NEPA statement are:

1. A permit issued by the Secretary of the Army to a private developer to fill tidelands for use as a trailer park (Zabel v. Tabb, 1 ERC 1449)

2. The approval by the Interstate Commerce Commission of an increased rate to those railroads hauling scrap metal. The Students Challenging Regulatory

Administrative Procedures (S.C.R.A.P.) were allowed to intervene in rate-setting proceedings with a request that rate preferences be given to recycled materials (37 F.R. 5202).

3. An order of the Interstate Commerce Commission allowing the Bush Terminal Railroad to abandon an unprofitable New York operation. The order was found by the court to have the effect of causing adverse environmental impact for which a statement should be prepared (City of New York v. U.S., 3 ERC 1570).

4. The action of the Atomic Energy Commission in issuing licenses for the construction and operation of nuclear power plants. This was found to be an activity which had inherent environmental impacts, so that the proposed licenses could not be granted without an environmental impact statement for each project (Calvert Cliffs, supra).

5. A Corps of Engineers license involving the issuance of construction permits to Consolidated Edison for a cooling system for an electric generating plant. Although construction had begun, the Corps was ordered to proceed with an impact statement to assess all effects of the proposed license (Citizens for Clean Air v. Corps of Engineers, 4 ERC 1456).

6. An finally, a proposed project by the Corps of Engineers to spray herbicides on the St. John River was found to be a project requiring an environmental impact statement, although on the face of the matter the benefits to be derived from the project outweighed any possible injuries (Lee v. Resor, 4 ERC 1579).

As a result of the requirements of NEPA, and the subsequent judicial interpretations requiring environmental impact statements for a wide variety of projects, most federal agencies have begun to establish rules and regulations governing the granting of licenses for projects that may affect the environment. An example of these rules and regulations is found at 36 F.R. 13722, where the Department of Interior has established regulations governing the implementation of the Geothermal Steam Act. However, not all agencies have been left with the opportunity of proposing their own requirements for implementing environmental regulations as Interior was under the Geothermal Steam Act.

The former Section 21(b) of the Federal Water Pollution Control Act required that any federal agency proposing to issue a permit or license must obtain a certificate from the state in which the activity to be licensed will occur, that the proposed activity is not violating or will not violate water quality standards. This requirement has been revamped by Section 401(a)(5) of the 1972 Amendments to the Federal Water Pollution Control Act passed 30 days ago. Although the procedure has been modified slightly, each federal agency still must nevertheless consider a state certification of compliance with water quality standards in its decision on any proposed license or permit which may result in a discharge into navigable waters, along with other NEPA elements.

Procedural Requirements of NEPA

In recognition of the fact that the implementation of NEPA involved a substantial revision of governmental decision-making processes, the Council on Environmental Quality published guidelines at 36 F.R. 7724, which explain the implementation of NEPA. The guidelines were quickly found in court. In Environmental Defense Fund v. Corps of Engineers, 325 F. Supp. 728, 2 ERC 1260, the court said of the guidelines, "Such an administrative interpretation cannot be ignored except for the strongest reasons, particularly where, as here, such an interpretation involves a construction of a statute by the men charged with the responsibility of putting that statute into effect." The court found that although the reservoir project in question had been approved in 1958, and construction had begun in 1963, that environmental impact statements for further construction would be required as that construction proceeded.

The language of Section 102(2)(C), which requires an impact statement for "any major Federal action significantly affecting the environment," has also been the subject of controversy. The projects which have been found to fit within this category include the following:

1. A federal prison to be constructed witin a residential area of New York City (Hanley v. Mitchell, 4 ERC 1153).

2. The granting of a loan by the Department of Housing and Urban Development for the purpose of assisting the construction of a 16-story high-rise apartment building that would concentrate population, increase automobile traffic, and generally have an adverse impact on surrounding properties (Goose Hollow v. Romney, 3 ERC 1087).

3. The conversion of 12 miles of Wisconsin two-lane conventional highway to a four-lane highway, with accompanying condemnation of land and increased use of the highway (Scherr v. Volpe, 3 ERC 1586).

4. The channelization of 66 miles of a creek that would result in a substantial reduction in fish population and a significant loss of wildlife habitation, that would combine with other projects to effect a significant quantity of wetlands (Natural Resources Defense Council v. Grant, 3 ERC 1884).

Projects which have been found not to require the preparation of an environmental impact statement include the following:

1. The conduct of a mock training exercise by the United States Marine Corps in a state park, where there was a finding that the potential environmental damage would be insignificant. The record in the case showed, as well, that the involved governmental operations had been planned from the inception to minimize environmental impact, and that the resultant environmental damage would be so insignificant as to not require an impact statement (Citizens for Reid State Park v. Laird, 336 F. Supp. 783, 3 ERC 1580).

2. The granting of a Lease of Indian Lands by the Secretary of the Interior. This case was found to be not subject to NEPA requirements because of the fact that the Bureau of Indian Affairs was charged with an obligation for "enforcement of appropriate land use regulations, pollution control and health and safety standards," so that the NEPA requirements for environmental assessment were preempted by a more direct obligation under statute (Davis v. Morton, 3 ERC 1546).

Nearly all federal agencies have published procedures concerning the necessity for an environmental impact statement and guiding the review processes. These guidelines, for the Environmental Protection Agency, may be found at 37 F.R. 881, published January 20, 1972. The guidelines of all agencies which have published guidelines are found at 1 ELR 46001 et seq.

EPA procedure centers upon an early inquiry or environmental assessment to determine if there is a need for an environmental impact statement. If there is no need found for an environmental impact statement because of the absence of a significant environmental impact, then a "negative declaration of environmental impact" is drawn, and circulated to all affected agencies of both the federal and state governments, as well as any affected parties who have made their interests known.

If on the other hand, it is determined that an environmental impact statement is necessary, then a notice of intent to issue an environmental impact statement is circulated to provide official notice of the beginning of the decision-making process, and to allow ample time for outside input into the decision-making process.

This raises the question as to the time to be allowed for public input into the review process. The Council on Environmental Quality guidelines provide only that an impact statement shall be provided to other state and federal agencies, and that it shall be available to the public as is other agency information under the Freedom of Information Act.

This question was settled somewhat by Daly v. Volpe, 4 ERC 1487, which dealt with the adequacy of notice of an environmental impact report. The court found the notice in question to have been inadequate to fulfill the requirements of NEPA. The court said, "There was insufficient notice to give the public enough time to consider the environmental impact of the proposal." The court then directed that an impact statement should be prepared and circulated, and a period of 60 days allowed for the submission of the comments of interested and affected parties.

It has been the practice of some agencies to issue "overview statements" which are intended to fulfill the requirements of NEPA in regard to a general policy of a particular agency. An example of this procedure is the Departmant of Interior impact statement concerning its policy on energy. This approach was considered in Natural Resources Defense Council v. Morton, 3 ERC 1558, in which the court found that additional impact statements were necessary to describe the environmental impact of each particular project which implemented the general policy stated in the overview statement.

All federal agencies are required by Section 102 of NEPA to consult with fellow agencies having particular expertise with regard to the environmental impact of the project being proposed. The procedural effect of this requirement usually involves a 30 day period for comment by the reviewing agency. This has been found to be an extremely short period in light of the complexity of some proposed projects, and extensions have been granted in exceptional cases, such as the Alaskan pipeline case.

Because of the language of Section 102, it was first thought that some agencies were exempted from NEPA requirements because of their particular expertise in environmental considerations. Two cases quickly dispelled this theory. Kalur v. Resor, 335 F. Supp. 1, 3 ERC 1458, found that the U.S. Army Corps of Engineers program for the issuance of discharge permits under the 1899 Refuse Act was not exempted from NEPA, and that the permits could only issue in conjunction with an environmental impact statement. This holding was confirmed in Sierra Club v. Sargent, 3 ERC 1905. Unfortunately, the effect of these two cases was to bar the issuance of any Refuse Act permits whatsoever, because the Corps of Engineers deemed it an impossible administrative task to prepare an environmental impact statement for each proposed discharge permit. This impasse was broken by the 1972 Amendments to the Federal Water Pollution Control Act, which transferred the permit-issuing authority to EPA, and at the same time exempted all EPA activities under the Act from NEPA requirements except for two categories. Those categories are the issuance of grants for the construction of publically owned sewage treatment facilities and the issuance of discharge permits for new sources.

However, as a reminder that there are safeguards governing the amount of consideration that must be given to environmental impact, Greene County v. FPC, 455 F. 2d 412, 3 ERC 1595, held that a lead agency cannot substitute the environmental assessment of an applicant for its own decision on the impact of a project. This requirement for intra-agency assessment presumably applies to those agencies exempted from NEPA yet having environmental responsibilities, as well as to agencies such as the FPC which come directly under its authority.

For those who have begun to feel that NEPA has the Government by its tail, I would like to state that there are several broad exceptions. First, it is apparent from the jurisdictional limitations of NEPA that not every federal activity is subject to NEPA review. In fact, there have been a number of cases which have challenged governmental activities, alleging that the provisions of NEPA have been violated, which have ended in a finding that the activity was not a "federal activity" or did not have a sufficient degree of federal involvement to justify the imposition of NEPA's requirements. In Boston v. Volpe, 4 ERC 1337, it was found that the construction of an airport runway was not a federal project, even though the airport authority intended to later qualify the project for a federal grant. The court said that "at least for the purposes of ruling on the propriety of the denial of the preliminary injunction, that a tentative allocation followed by an application for airport development aid, does not so federalize a project that all work must stop until a satisfactory environmental impact statement has been issued by a putative federal grantor." The court felt that there was adequate assurance of environmental protection because "in most cases a State or community would be sensitive to its environmental obligations, not only to avoid jeopardizing its chances of obtaining assistance for the specific project, but also to avoid a negative report on future projects associated with the same facility. For, as we have noted, the federal agencies cannot close their eyes to ill-advised actions of the past as they assess a project in the present."

Secondly, to further indicate that the effects of NEPA are not all-pervasive, Bradford Township v. Highway Authority, 4 ERC 1301, a case brought in the absence of any federal funds or license, reached a similar conclusion. The court said, "There is no claim that the Federal Government or any federal agency is engaged in any manner in the construction of the tollway extension. Nor is it alleged that any federal funds are to be used. Since the procedural requirements of the National Environmental Policy Act are applicable only to federal agencies, it is patently clear that these requirements have no pertinence to the facts of this case. Other than the procedural requirements just mentioned, no judicially enforceable duties are created by either NEPA or the Environmental Quality Improvement Act."

Content of Impact Statements

Section 102(2)(C) (supra) establishes the elements of an environmental impact statement. These are mandatory items, and each must be included. Although it would seem patently clear that all required elements should be considered in conjunction, it took the case of Environmental Defense Fund v. Corps of Engineers to affirm this principle. The court reiterated the language of Section 102(2)(C) in requiring a "systematic interdisciplinary approach to the consideration of environmental values."

The requirement to discuss and consider the "alternatives" mentioned in Section 102(2)(C) was dealt with in Natural Resources Defense Council v. Morton, 3 ERC 1558. The court required the consideration of all possible alternatives, even those that did not seem to be within the practical realm of the Department of Interior, or its licensee, to put into effect. The standard the court imposed was, "so long as the officials and agencies have taken the hard look at environmental consequences mandated by Congress, the court does not seek to impose unreasonable extremes or to interject itself within the area of discretion of the executives as to the choice of action to be taken."

From reading 102(2)(C), it would also seem clear that the involved agency should consider opposing views. The notorious Amchitka Island case left no doubt in this respect, stating that "the ultimate decision must of course take into account matters other than environmental factors, but . . . the officials making the ultimate decision, whether within or without the agency, must be informed of the full range of responsible opinion on the environmental effects in order to make an informed choice." (Committee for Nuclear Responsibility v. Seaborg, 3 ERC 1126.)

The number of cases quoted above may leave one with the impression that each and every attempt of a federal agency to comply with NEPA has been tested and found lacking by the courts. However, it is true in this area, as in all other areas of administrative law, that there are only two general bases for reversal of an administrative determination. The first is that the agency has not acted within its own administrative guidelines or within the guidelines set for it by law. The second is that the decision on the facts in question was "arbitrary and capricious." That is, the courts will look to the facts only to the extent that they might find a reasonable basis for the agency's decision. If the reasonable basis is there, then the decision will be allowed to stand. In some cases, even though an agency decision might seem arbitrary and capricious, grave economic consequences give the court second thought. There have been a number of cases which have attempted to either enjoin or modify construction projects after there has been a large commitment of financial resources. The courts have been split on this issue, some refusing to give effect to NEPA once a project has been initiated and the commitment is irreversible; other courts have allowed an injunction to be entered against a construction project although the construction may have gone as far as 30 percent toward completion.

In few instances has a project been halted completely by court order. The normal procedure is to remand the issue to the licensing or constructing agency for preparation of a full environmental impact statement and reconsideration of the full effects of the project in question.

Citizen Standing Under NEPA

The issue of citizen standing has been hotly debated in the courts in almost every area of NEPA involvement. The cases have been brought because of failure to file an environmental impact statement, failure to meet the statutory guidelines, or inaccuracy or insufficiency of the statement supporting the proposed action. The United States Supreme Court ruled this summer in the case of Sierra Club v. Morton, 3 ERC 2039, that an environmental group whose members have no direct personal interest in the issue of a case is not entitled to bring suit under NEPA. However, the court left the door open with the statement, "The requirement that a party seeking review must allege facts showing that he is himself adversely affected does not insulate executive action from judicial review, nor does it prevent any public interests from being protected through the judicial process. It does serve as at least a rough attempt to put the decision as to whether review will be sought in the hands of those who have a direct stake in the outcome."

As an interesting corollary to Sierra Club v. Morton, a San Francisco group known as "San Francisco Tomorrow," has been denied standing to enforce the requirements of NEPA in regard to the construction of two urban renewal projects in San Francisco. Again, the absence of a pecuniary interest made it impossible for the plaintiffs to compel the construction agency to comply with the requirements of NEPA (San Francisco Tomorrow v. Romney, 4 ERC 1065).

CONSERVATIONIST'S ATTITUDES ABOUT ENVIRONMENTAL IMPACT STATEMENTS

By

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Last week while setting the stage and preparing for this meeting I was reading some material in the New York Times regarding environmental issues in the election which took place yesterday. Under a Washington dateline, the article went on to say that ballot propositions on environmental questions across the country indicate twice as extensive voter concern with ecological matters as was reflected in the 1970 off-year election. In Colorado, debate is swirling over whether the State should be host to the 1976 Winter Olympics. Promotion-minded Coloradans pointed toward 1976 and thought they had the cold-weather games just about in the bag. But suddenly they found themselves in battle and an election with citizens who regarded the Olympics show as an intrusion on their fragile Rocky Mountain landscape and questioned further on land use and state growth policy. In California, there is heated controversy over an initiative measure to take developmental authority over the state's 1,072 mile coastline--largely privately owned--away from local government and lodge it with a new state commission and six regional commissions. In the State of Washington, a 1972 legislative enactment on shoreline management left authority with local officials. Voters yesterday had the chance to alter this. Floridians voted on ratifying the State's land Conservation Act of 1972. It calls for the issuance of $250 million worth of state bonds to buy up seashore and environmentally important natural areas because they are threatened with questionable development. North Carolina's ballot had an "Environmental Bill of Rights" proposal, such as several other states have adopted. This would make it state policy to protect environmentally valuable natural resources. New York State's proposed $1.15 billion environmental bond issue would allocate $350 million for land acquisition through additions to the state's forest preserve, preservation of wetlands and acquisition of unique natural areas and waterways. And the list reads on and on. Very clearly, as I view the people of this country, at least a good part of them are in a frame of mind to provide support for the environmental-quality issue at the grassroots level by taxes and bond issues. This movement, of course, has basically developed after the strong efforts of the Federal Congress and the executive branch to provide a base of environmental law of which the National Environmental Policy Act of 1969 was one part. The spirit of this act is to translate those honest concerns of our nation into something more tangible than assurances that everything's fine. Clearly, everything is not fine, a realization that we have come upon late, but surely not too late. Until recent times, the costs of environmental misuse grew very gradually but were accumulative. Until recently it seemed possible to defer payment. Until recently the right to damage and degrade the countryside was widely accepted and thus widely practiced-but the hour comes when things operate differently.

Before getting into the heart of the issue on impact statements, I would like to develop the definition of a conservationist, which might help in understanding the role of this brand of scientist at this meeting. My educational background and training is rather standard for a modern conservationist. An undergraduate and graduate degree in field zoology and botany--essentially the building blocks for a wildlife ecologist with emphasis on population dynamics in relationship to the environment and special habitats. My early training carried the message that a conservationist dealt with the research and management (wise use) of the renewable natural resources, or very simply applied ecology. In this broad sense, the term conservationist transcends smaller compartments of it. It has been used sometimes to mean little more than soil conservation, sometimes merely preservation, e.g., of an animal or habitat threatened with extinction. Presently, I prefer to think of conservation as concerned with the health of ecosystems in relationship to man's proper needs.

As a professional group, conservationists (applied ecologists) have demonstrated a very close affinity to the land, water and plant systems and the animal life associated with them. They read and measure the landscape and its fauna and flora with a trained eye and a methodology for the environmental picture. Actually, in a historical review of national trends, the conservation movement appears to have been the first organized action among the American people against the degradation of their natural environment.

When asked the question "how do we conservationists feel about the environmental impact statement business?", "Encouraged" is probably the best word of evaluation I could give. Conservation agencies like our Missouri Conservation Department have historically been working on and reviewing federal construction projects over a long period of time in reference to their environmental problems and alternatives. It is not a new thing and we certainly do not qualify as instant ecologists. My whole professional life over a 30 year period and that of my staff and associates has been one series of research studies, reports and data gathering procedures to find answers and solutions to ecologically serious problems brought about by our aggressive industrial and agricultural system. The landmark Fish and Wildlife Coordination Act of 1958 provided that wildlife conservation shall receive equal consideration and be coordinated with other features of water-resource development. I am not really in the best position to say how successful we have been through the long-pull concerning these early environmental matters, but we did have an occasional success in preventing environmental degradation and providing alternatives.

With implementation of the National Environmental Policy Act of 1969 (NEPA) three important facets have changed the ballgame thus accounting for our encouraged attitude and improved role. First of these points involves public visibility and awareness of the environmental problems on our national landscape. It was a mightly long and lonesome period of time for concerned conservationists prior to the 1960's and the final passage of NEPA. There was little or no evidence of major environmental law nation-wise - virtually no air, water or solid waste standards, and certainly almost no legal recognition of terrestrial and land use ecological problems. The general national mood on natural resource and environmental problems began to consolidate in the early 1960's. Some excellent writing and research reports on some very serious environmental mismanagement caught the public eye. Since that time low visibility has ceased to be a problem. The concern for environmental degradation has been transformed from a passive obsession of the few to a popular crusade of the public.

The second important difference brought about by the passage of NEPA has been the role of the general public. The opportunity for the layman-citizen to be heard, to review plans, projects and statements are a part of the new rules for natural resource-environmental-quality concern. This surely makes for wide open democratic processes. Admittedly, it becomes extremely complex but we still live for that dream of government by the people and for the people. Where we have overwhelming national problems needing the honest scrutiny of a concerned and often intelligent public, the environmental quality area becomes a natural for participation.

The third facet of change brought about by the NEPA program has been the responsibilities of the courts. At the present time, there is little doubt that the courts are the prime movers for environmental reform. Since the decision of Scenic Hudson Preservation Conference v. Federal Power Commission in 1966, it has been the courts that have led the assault on environmental mismanagement. Public interest groups have utilized the judiciary to force action by the executive and legislative branches of the government. In NEPA a statutory course of action (enforceable through the courts) is present if a governmental agency fails to make a systematic evaluation of potential environmental damage which could result from agency activities, or if it fails to consider plausible alternatives to the proposed actions. Both citizen suit provisions and NEPA enable the public to enforce the requirements of the law. No longer can officials use sovereign immunity and restrictive standing doctrines. So, this recent legislation has established a new level of public accountability for government action, which affects the environment.

The development of these new doctrines of environmental law have had an impact on our conservation-ecology sciences second only to the development of high speed computers. The courts have in effect legitimatized applied ecology. Interestingly enough, the law has become better developed than have our methodology and analytical tools needed to satisfy the intent of the law. Conservationists and applied ecologists are being asked for guidance in establishing the norms and standards for environmental quality with which to gauge, and for the methods and concepts needed to evaluate the environmental impacts. Thus, our professional challenge is to make our ecological science relevant to the environmental problems facing our nation. We are now being called upon to apply our fundamental knowledge to the real problems of the larger picture.

The larger picture is, of course, part of our dilemma. A case in point is the pressing need for analytical systems to evaluate and predict the probable environmental impacts of cultural activities. During the last decade there has been wide development of systems ecology, but we are still a long way from a viable comprehensive landscape model. There are many gaps in our information on basic ecological processes. We see research on our solution to this problem, but it must be conducted in such a way that it interlocks with the applied information required by today's environmental problems. In other words, common sense information about and in relation to our life support systems. This can tie directly to our economic, social, and esthetic values and allow for quality decision making. Following this point, however, we will still have to decide what it is we want, and what we are willing to give up or tolerate to have it.

By taking a close look at the problems of conservationists who are working with impact statements over the last two years, some critical factors and elements have surfaced. Let's take a closer look at some of these.

In the original NEPA act, the policy is set forth that the nation may (I have highlighted the complete wording) be assured of esthetically pleasing surroundings, attain the widest range of beneficial uses of the environment without degradation, preserve important natural aspects of our national heritage and maintain an environment which supports diversity and variety, and enhances the quality of the renewable resources. Now in practice of our review of environmental statements, we work to achieve those ends; however, officials in EPA generally indicate that their main work and assistance in preparation largely must be concerned with air, water, solid wastes, pesticides, radiation and noise. This is not a totally realistic viewpoint in the consideration of environmental degradation. Missing from this array of factors are the basic consideration of the landscape and the associated lands and vegetative habitats around the projects under consideration. Conservationists see the value of diversity as a stabilizing element on the landscape. Stability is the natural component of the environment very closely connected with what Aldo Leopold has referred to as the "land ethic" or "health of the Land," or conservation-conscience. It is important that high priority for protection be given to the remaining acres and pieces or patches of the natural landscape. I would further suggest that diversity of the landscape performs an important esthetic and psychological role for man. Now, in looking at the above commentary on land use problems, I see conservationists generally calling for emphasis on the importance of the landscape's vegetative zones and their arrangement, and giving them equal rating with the current emphasis on the polluting aspects of the chemical and industrial world. Our environmental concern must include both facets to produce and maintain the quality of our natural resource base.

Another one of the major problems found in the impact writing business regards the long lists of biological species associated with the project. Catalogues and lists of trees, shrubs, grasses, mammals, birds, fishes, insects, etc., do not necessarily provide the decision maker with valid conclusions on environmental degradation. Only when these species lists are worked into the natural animal and plant systems and developed to the participating role, do these lists become valuable.

The wildlife ecologist has found himself in a very unusual position in the matter of environmental impact statements. The field of applied ecology in wildlife and fisheries management is quite well-developed. For obtaining environmental impact readings the wildlife scientist has more data and information on flora, fauna, and existing habitats, animal numbers, harvets, etc., people involved, than most any other source. We find ourselves deluged with requests from agencies, consultants, and industry writing for the total data on hand for the project area. The same basic data and interpretations are available to all. I honestly believe the wildlife ecologist is the most sensitive to and knowledgeable about the natural environmental conditions. Who else is assigned this particular natural resource problem and spend almost their total time working on a species basis in a statewide capacity. So, our conservation scientists do hold a good part of the data and facts on these environmental impact situations. However, all of this is not without its problems. Fish and wildlife and their associated habitats are very excellent bioassays of environmental condition. Because of this situation, the case of documenting and detailing potential degradation becomes very controversial in interpretation. One of the major problems conservationists deal with is the "finite" resource. If we are dealing with natural vegetative areas, say a native prairie, a small mouth bass stream, a natural marsh, a blue-hole spring, and so on, the feature we are dealing with is a very limited natural resource. No more will be available in the future. Man has pushed this nation's landscape around so dramatically in the past 200 years, we wonder how much more we can afford to lose and still maintain any national conservation integrity. Some projects such as water control structures bring about massive loss of existing natural environment in the project area.

The problem is emphasized because nothing really is sacred or secure in this day and age from urbanization, industrial explosion, resource exploitation or the new expanding technology. The real questions come up by offers of mitigation, the so-called replacing of land and water and other associated resources by project additions. On a "finite" resource base, there is no such thing as replacement--when a resource is lost it remains lost and we have just that much less.

Another problem of magnitude in the impact statement routine is the general lack of concern for the incremental effects of a series of related projects, some of which may be only on the drawing boards. This approach makes the impact statement like "a bridle with blinders." In dealing with the specifics of the individual project, little or no accounting is being made for the numerous projects to come. Basically, it is like taking one slice out of a whole pie and calling that piece the whole picture. Natural systems are like many delicate pieces of machinery. Only by careful fitting, adjustment and maintenance will the system remain intact and continue to make its contribution. Conservationists look forward to the day when incremental effects are given their full appreciation and used in the environmental quality determination.

Invariably, the matter of cost-benefit ratios come into the picture and I would like to make a few comments regarding them. A number of years ago, economists brought the system of cost-benefit ratios to the arena of public construction projects. The technique has undergone much refinement over the years but is nevertheless susceptible to manipulation through arbitrary assignments of values to costs and benefits. The fundamental weakness of cost-benefit analysis is basically a consequence of insufficient knowledge. Environmental systems, which are essentially biological and physical in character do not fare well in this type comparison. Knowledge of man's environmental needs and relationship and landscape relationships generally is not presently sufficient to support this comparative mathematics to the extent needed for wisdom and rationality in environmental decision making. More knowledge is needed and to obtain and apply this knowledge some new relationships among the sciences and new emphasis in education, in engineering and scientific research and development will be required. The very things people are so concerned about these days--the fine ecological make-up of our countryside with all the attendant esthetics are basically missed by the cost-benefit ratio procedure. It is very difficult to put a dollar bill value to the human experience and his well-being but we do need to account for it. Perhaps this system is a crutch we wll have to live with until the methodology arrives.

There are a series of other problems developing as we study the impact statement procedure. Without going into much detail I would like to list them with a few comments.

We see a need for region-wide overview statements. Separate projects even by separate agencies in the same region need to be environmentally analyzed for the cumulative effect and impact. The piecemeal approach will never get the quality job done needed by fragile environmental components. How can resources be protected if the left hand doesn't know what the right hand is doing?

One of the most critical problems we see in the impact statement business is the ultimate fate of the document at the final stage of funding the projects. Admittedly, NEPA was intended to be a planning tool. The 102 statements were to be forerunners of government decisions on projects having potential for environmental damage. Unfortunately, there is some evidence they are too often considered legal requirements to be complied with at a low level posture, formulated at the completion of the planning process. This situation brings about only nominal recognition given to possible alternative actions. The broadly written Act is quite unwieldy, so that it is again the responsibility of the courts to interpret the requirement of the statute.

Another problem that we would like to deal with is the long complicated and detailed characteristic of the statement. It ends up providing a document that most laymen and interested public cannot read or do not have the time to read. I would hasten to comment that this might also apply to some of the agencies who are reviewers. There is a middle ground needed in the preparation of the statements. There is also need for abbreviated, concise, but accurate summaries for general distribution. Documents of this type would help break down communications problems that exist between the agencies concerned and the interested public.

Recently there has been a search or quest by NEPA and cooperators toward environmental indices. Just two weeks ago Russell Train wrote an article in Science on the question of need for Environmental Indices. No doubt there is need to highlight the major trends and existence of significant environmental conditions through an averaging procedure of existing data. This has been done in our economic world for gross national product, cost of living and even unemployment. But the problems of developing good indices depends on good data. We find many gaps in our total environmental data bank which precludes use of the data but there is also the lack of scientific knowledge necessary to properly weigh the components of the index. At this stage in time, I find most conservationists very worried about the use of numerical indices--and the substitution of round figures for detailed in-depth findings. As I have said before today, this environment we are considering is of a very fragile nature. I am not aware of a professional capability which will allow us to generalize on the environmental makeup and proceed to the decision making process. The whole scientific effort must be able to synthesize the data available, rather than use of the old intuition processes which fail to relate to our present day environmental values.

There are many other problems associated with the impact statement procedure but I believe the most needed tool right now is the availability of a system of planning to allocate our finite resources among the competing uses. We must have a set of priorities for the landscape and the uses of it. Now, we are in the middle of some expected legislative adjustments to NEPA as a result of judicial interpretation. I believe we will see the evolution of a comprehensive environmental planning process with the federal government, once the initial shock and dismay of the impact procedure runs its course. Some of the leadership of programs by NEPA has filtered down to the state level and we have seen considerable accountability for state agency action. Most of us expect similar procedures to be extended to the private sector.

If we are to keep up the standards and values of our countryside in the ever expanding economic and population situation, there must be devised a system of resource planning to preserve environmental quality, the long term plans must be implemented through a program of land-use control. Traditional land use policy must be changed if we are to give environmental quality the chance we are working for. Since the early 1970's land use zoning has become commonplace and the courts seen willing to support restrictions on land use as long as the regulation does not allow unlawful appropriation without compensation.

In the past, land use control has been administered by local planning and zoning commissions (example of Columbia). Decisions are generally made on the basis of local need and jurisdiction. Only very frequently are regional needs considered. Conservationists see an environmental planning system which must meet the interacting needs of the total regional unit. Really what we are saying--we must substitute regional planning and certain land use controls for local authority. This is always a rough route for the general public to traverse. Such type planning and information will aid the decision-makers to develop a balanced plan for growth yet minimizing environmental damage. We see a merging of the environmental sciences with other disciplines and arts to develop regional plans and predict their impacts on the regional landscapes.

SUMMARY

Among conservationists, the whole program of the National Environmental Protection Act of 1969 and its implementation of the impact statement procedure is a recognition that gives an encouragement and a new sense of priority and urgency to conservation programs. To the complaints that we're not advanced enough in our conservation and applied ecological sciences to handle the evaluation of our environmental degradation, I would comment, you have to crawl before you can walk. Sure, there are gaps in our knowledge, but we are pretty much on target on most of the real and critical environmental problems. The problem that the interdisciplinary community of scientists, engineers, sociologists, have is in understanding the public's priorities. Now the real problem remains to define natural resource problems and then set about to give them a priority ranking. We will never get this job done in a competent way except through the route of the planning process and the ultimate use of land-use control.

We are past the stage of arguing about the natural resource and environmental degradation. It has happended in the past and continues at a very fast rate, right under our eyes today. Each year we see continuing heavy pressures being placed on our natural environment because rapid technological growth produces a strong desire to convert natural environment into a developed environment. In this context, "natural environment" includes the ecological systems ranging from little used wilderness to moderately used forests, grasslands, rivers, estuaries and oceans.

Our public is quickly developing a strong awareness for the natural environment, its function, and values.

Speaking as one who has seen a long period of almost complete disregard and mismanagement of our landscape from both the economic, recreational and esthetic viewpoints, I would again say we are encouraged by the trend of natural resource management brought about by NEPA and its programs of environmental assessment.

PRESENT STATUS AND PROBLEMS
OF
ENVIRONMENTAL IMPACT STATEMENTS

By

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On January 1, 1970, President Nixon signed the National Environmental Policy Act of 1969 (PL 91-190). Its purposes are: To declare a National policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality.

The Act is divided into two parts. Title I, Declaration of National Environmental Policy lists the goals, administration and review procedures of the Act.

Title II of the Act created in the Executive Office of the President, a Council on Environmental Quality composed of three members who are appointed by the President with the advice and consent of the Senate.

The Council on Environmental Quality is the final recipient of Environmental Impact Statements and serves an important advisory role to the President and Federal agencies. The Council has the responsibility to determine if all environmental effects are considered and if the correct review processes have been followed in the preparation of impact statements for Federal projects.

The Council on Environmental Quality guidelines were published in the Federal Register, Volume 36, No. 79, dated April 23, 1971. These guidelines interpreted the National Environmental Policy Act by defining what types of projects are included, and further explaining the five points listed in Section 102(2)(c) of the Act. The guidelines also listed the agencies which are to be included in the review process according to their area of responsibility.

An agency must submit a draft Environmental Impact Statement to the Council on Environmental Quality and to all Federal agencies having expertise in the environmental matters concerning its projects. After a review period of at least 45 days, the originating agency submits the final Environmental Impact Statement to the Council on Environmental Quality. The final statement must include the comments of all of the reviewing agencies.

The passage of the Act has caused a great stir among Federal agencies and, state, municipal, and private concerns requiring federal grants, permits or licenses. The concept of an agency or organization being forced to identify its adverse as well as its beneficial impacts on the human environment is not easy to accept. It has always been traditional to emphasize the favorable benefits of projects and minimize or overlook the adverse impacts.

Here, I may emphasize that the law requires an environmental impact statement on all actions significantly affecting the quality of the human environment. It does not differentiate between beneficial or adverse effects.

One of the major problems which has arisen because of Section 102(2)(c) of the Act is the Congressional intent of the five points. Therefore, I will atempt to interpret the requirements of this Section and the Council on Environmental Quality guidelines.

The description of the proposed action should include sufficient discussion to inform the decision makers and the public about the details of the project. It must specifically include the area involved, the resources affected, the changes occurring to the physical setting, the alterations to ecological systems, and the time frame during which these changes will occur. As an example, a proposal for a reservoir project should include the following information: Project purposes; quantities of water stored; rate, schedule and depth of releases; operation and maintenance programs; and any other project data which are needed to evaluate or identify the environmental impacts.

The first point required by Section 102(2)(c) concerns the environmental impact of the proposed action. The Act requires an impact statement on all projects having a significant effect on the quality of the human environment. Since these effects can be favorable as well as unfavorable, the statement should discuss both the beneficial and the adverse impacts.

This section should contain a description of the environmental interrelationships in the immediate area and the total affected area. Major actions, such as storage reservoirs, pipelines, mining or logging operations, road construction, recreation developments, or navigation projects will affect air, soil, vegetation, and water quality in the project area. They may also be inducements for industrial, recreational, agricultural or residential development with related environmental impacts.

Point 2 requires the identification of any adverse environmental effects which cannot be avoided should the project be implemented. This should include all of the primary adverse impacts such as loss of agricultural production, destruction of wildlife habitat, degradation of air and water quality, increased noise levels, generation of solid wastes, undesirable effects on endangered species, displacement of people, etc. The list is endless and it is different for each project.

In addition, this section of the impact statement should identify secondary adverse impacts which are not directly related to the project site. For example, a fossil fuel power plant will place additional demands on our fuel supplies, subject various areas to power line construction, and may increase the need for additional transportation facilities.

Point (3), requires the responsible agency to study, develop and describe appropriate alternatives to the recommended courses of action. The analysis of each alternative should include the economic, sociologic and environmental impacts as compared to the recommended project. The alternatives should also discuss needs which may be of a higher priority in the future. For example, urban freeways will be worthless if, in the future, we change to a different form of transportation such as air cars.

Alternatives to a construction project may involve a completely different approach to solve a problem. A flood control reservoir may be proposed to prevent damages to a community, however, proper zoning in the flood plain could have prevented this need for a reservoir.

Most actions involve a number of potential areas where an imaginative approach could lessen adverse environmental impacts while still meeting a majority of the projected needs. An environmental statement should describe these alternatives objectively so that decision makers can compare and contrast environmental impacts of the various alternatives.

Point (4) requires an assessment of the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term environmental productivity. A project or action must be evaluated in terms of use of renewable and non-renewable resources. Are the environmental costs being paid by the people who gain the benefits or by future generations who may be left with only the cost? Most significant resource based actions have a long-term effect since there is a foreclosure of choices for future generations. For example, filling estuaries may provide additional land space for development, but eliminate a future choice of use by destroying a valuable natural resource.

Point (5) requires description of an irreversible and irretrievable commitment of resources. All project actions involving construction or development are considered to be irreversible because they commit future generations to patterns of use which cannot feasibly be altered. The resources expended during construction are generally considered to be irretrievable. Furthermore, the loss of annual production renewable resources attributed to the project is certainly irretrievable. Yesterday before the election, the people of this country had alternatives to consider. Today, they have made an irreversible commitment for the next four years.

In addition to the 5 points required by Section 102(2)(c) of the Act, the Council on Environmental Quality guidelines suggest a 6th point in the impact statement. It requests a discussion of problems and objections raised by local entities on the project or any of its aspects.

The purpose of this is two-fold. It encourages the proposing agency to contact and communicate with these groups and it provides reviewers a reference to groups who may have personal knowledge of the impact of the proposal.

Now let's look at some of the major problems which have developed.

Many federal agencies fail to recognize that their programs or actions do have a significant effect on the quality of the human environment. In short, they are not preparing impact statements. About 90 percent of the draft statements which we have reviewed in our Regional Office have come from the Department of Transportation and the U.S. Army Corps of Engineers.

Each federal agency is responsible for determining when and if an impact statement is required for a project, grant, permit or license. This probably causes more problems in their compliance with the Act than any other single factor. Only a few agencies have taken the attitude that an Environmental Impact Statement will be prepared on any project if there is a reasonable indication of significant impacts. The others are taking the approach that they will prepare an impact statement if they are threatened with court action or if they are pressured to conform to the Act.

The Council on Environmental Quality guidelines, as mentioned earlier, fail to adequately define significant impact. As a result, we have significant impact being determined by the cost of the project, by the number of kilovolts carried by transmission line, or by the number of housing units constructed. This type of reasoning is illogical because the cost, number of housing units, or voltage does not determine the environmental impacts. Perhaps each agency should obtain a list of possible environmental impacts. If a project significantly affects one of these impacts, an impact statement should be prepared.

If a federal agency's responsibilities do not provide a significant impact on the human environment, then I would question why the agency exists. I certainly hope that each federal agency's objective is to improve the quality of the human environment.

There are several stages of development leading to an Environmental Impact Statement as required by the Act. Each application to a federal agency for a grant, permit or license must include an environmental assessment for the project according to guidelines supplied by the agency. The assessments may also be called Environmental Analysis, Environmental Reports, or Environmental Studies, and may be prepared by municipalities, consultants, or members of the general public.

When the federal agency receives the application and the assessment, it must then appraise the environmental impacts of the project using the data provided in the assessment and the expertise of the agency. This appraisal leads to the decision to prepare and Environmental Impact Statement or a Negative Declaration.

A Negative Declaration is a document which states basically that the agency has appraised the environmental impacts of the project and does not believe that they are significant. In some cases, negative declarations may be inappropriate because of significant environmental impacts which were overlooked. The response to objections may be handled by either preparing an impact statement or deleting the objectionable features from the project design. Neither the law nor the Council's guidelines require that negative declarations be circulated outside the agency proposing the action. Therefore, there is no way to review impacts of projects covered by negative declarations.

Problems with Environmental Impact Statements often originate within the agency preparing the statements. The preparation has stimulated an evolutionary process. Initally, in some agencies, the project engineers were assigned to prepare the impact statement. Since they designed the project, they found it difficult to be objective, because anything adverse reflected upon their design. This has led to the employment of environmentalists who work with the project engineers to prepare the statements. Many times, they attempted to write impact statements on projects which were designed prior to the Act and these project designs did not consider environmental impacts. This process has evolved to the point that staff or consulting environmentalists are looking at projects in the planning stage. We will see future projects being designed with less significant impacts.

It is very important for each impact statement to include every detail of construction and operation and maintenance which may even potentially affect the quality of the environment. In some instances, we have learned that certain facets of proposed projects were omitted from discussion in the statement. These may have been oversights, but they may have been deliberate omissions. When such omissions are eventually discovered by reviewing authorities, the natural result is suspicion that other impact statements may not be fully factual and objective. To effectively implement the National policy on environmental quality, it is imperative that every Environmental Impact Statement be as complete, factual, and objective as possible.

Primary impacts and effects of a project are easily determined for input into an Environmental Impact Statement. However, the Council on Environmental Quality guidelines state that secondary impacts must also be discussed in an impact statement. This is where difficulties arise. Secondary impacts are those which are not directly related to the construction or operation of a project. A reservoir project may stimulate the development of recreation facilities such as, resorts, motels, stores, service stations, etc., and these may have secondary impacts on sewage treatment plants, water supply systems, and solid waste disposal facilities. If each agency claims that they are not responsible for secondary impacts, then we are left with "Happenings" for which there is no control and a society in which everyone claims, "I didn't do it."

Now let's look at problems concerned with alternatives.

When an impact statement discusses alternatives to the proposed action, quite often, the only one mentioned is "no action" or "do-nothing." This is usually dismissed by the statement that "do-nothing" foregoes the benefit to the public. Seldom is the alternative of not building a project adequately compared with other alternatives on the basis of environmental impacts.

In the initial planning for federal projects, several alternatives are normally considered. Many impact statements discuss these alternatives, however, they usually do not contain an accurate evaluation of the environmental impacts. In fact, the final project is usually selected for economic or engineering reasons.

In many cases, practical environmental alternatives to a project are beyond the normal expertise of an agency. Highway Departments, for example, are charged with the responsibility for developing good transportation systems for motor vehicles. They are not charged with the responsibility for developing mass transit systems. Yet mass transit systems in large cities may be more critically needed than additional freeways. Such systems may be able to transport more people with less air pollution, noise pollution, and parking problems.

We are approaching an era where the environmental alternatives are as important as the economic alternatives, if the citizens are willing to pay a little more for projects which will minimize adverse impacts.

So far, we have not seen any attempts to allocate monetary environmental costs to projects or alternatives although there has been mention made that the courts and Congress might require this. It would be very difficult to assign dollar values to many of the various environmental impacts. Trees, for example, might be assigned a value according to their market value, or their replacement cost, or a grove of trees might be evaluated according to its importance to hunters or recreationists who use it. Can we evaluate the value of a tree to a poor dog living in an area without fireplugs? Furthermore, the conservation or recreation oriented agencies and groups would probably disagree with the value assigned by the originating agency. Practically speaking, if cost values were assigned to both primary and secondary adverse impacts, then logically benefits would have to be assigned to primary and secondary beneficial effects. Of course, many of the construction agencies are using secondary benefits to enhance the project image.

The problem of timing in the review process often impairs the effectiveness of an impact statement. If a reviewing office happens to have an unusually large number of impact statements to review, less time can be devoted to each one. It is very important that all pertinent details of the project be included in the statement. Quite often, necessary information is omitted from the statement and the reviewer must attempt to locate the missing facts or make a site visit upon short notice. For instance, the location of borrow areas for highway projects is often determined after approval of a project. However, the proposed areas should be discussed in the statement.

After a final statement is submitted to the Council on Environmental Quality, any interested parties have 30 days to submit comments on the final to the Council. Often, we receive finals with only 1 or 2 weeks left to review and, sometimes, we receive final statements after the review time has expired. This situation does not give a reviewing office the necessary time to check if its original comments have been responded to and notify the Council if the final is unsatisfactory. The agencies preparing statements should mail the finals to the reviewing agencies at the same time they are submitted to the Council.

Since the passage of the Act, the Council on Environmental Quality has received approximately 3400 draft and 1900 final Environmental Impact Statements. Our region alone has reviewed approximately 325 draft and 100 final Environmental Impact Statements.

In the two and a half years since its enactment, the National Environmental Policy Act has gone far toward fulfilling its promise as one of the major pieces of Governmental reform legislation in decades. It has had at least five clearly beneficial effects on the Federal Government.

First, it is a major step in bringing national policies in line with modern concerns for the quality of life. For the first time, maintaining environmental quality is acknowledged to be "The continuing responsibility of the Federal Government." Each agency has had its horizon broadened to include not only its own concerns, but also the need to "assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings."

Second, the impact statement process provides a systematic way for the Government to deal with complex problems that cut across the responsibilities of several agencies. In the past, different agencies have often responded to these problems in a piecemeal, uncoordinated fashion, largely because of the lack of a mechanism for shaping comprehensive policy. By forcing interagency consultation and attention to a broad range of effects and alternatives, Section 102 of the law fosters more sophisticated Government decision making. The Environmental Impact Statement process discloses the need for more comprehensive policies and programs in areas such as energy, transportation and water resources development. Thus, it is a catalyst for more sensible policy formulation and program development.

Third, the impact statement process has opened a broad range of Federal Government activities to public scrutiny and participation. A written study of environmental effects, including an analysis of available alternatives, must be made available to the President, the Congress, and the public, before an agency acts. The public, in turn, has an opportunity to evaluate and comment on the agency's analysis. This new element of public participation should contribute to more careful and conscientious decision making.

Fourth, agencies whose personnel have reflected a narrow focus of concerns are being required to supplement their staffs with persons of different backgrounds relevant to environmental issues. The National Environmental Policy Act's required "interdisciplinary approach" means that personnel must be hired who bring not only new skills, but a fresh viewpoint into the agencies. Over a period of time, this influx should lead to sharper questioning of traditional assumptions within the agencies. Out of it should emerge an institutional viewpoint that is more sympathetic to environmental values.

Fifth, PL 91-190's initiatives are enforceable in federal court by citizen suit. This keeps each of these requirements from being an empty exhortation. What the Act requires of the agencies is often difficult and uncomfortable. It is only natural that agencies are sometimes reluctant to question accepted goals and to do the work demanded by the Environmental Impact Statement process. The willingness of citizens to sue to vindicate the National Environmental Policy Act and the vigilance of the courts in enforcing the Act help to insure that the agencies take their new tasks seriously.

The National Environmental Policy Act has had a positive effect on Government decisions, although it is difficult to assess accurately the size of this impact. The substantial number of impact statements filed with the Council is a sign that many agencies are responding to the Act. But the best indication available at this juncture is probably the subjective impressions of those who work with the agencies on environmental matters on a close, daily basis - the Congressional committees that oversee the Act, the environmental groups, the Council on Environmental Quality, and the Environmental Protection Agency. Our Regional Office's contact with agency actions under the National Environmental Policy Act leads us to believe that desirable changes are in fact underway in the Federal Bureaucracy. There is still much room for improvement. Not all agencies are successfully identifying actions subject to impact statements. Statements are sometimes prepared too late to have an effective role in decision making. Viewpoints and practices are changing more quickly in some agencies than others. But the Federal Government, at the deliberate pace characteristic of large institutions, is falling into step with the Nation's new environmental consciousness expressed in the National Environmental Policy Act.

RESEARCH, EDUCATION AND THE ENVIRONMENT

By

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I stand here today fighting an almost irresistible urge to plead that you put rational thought into your discussions pertaining to conservation of our environment. That your discussion emphasize that which is reasonable and do-able, and that you look upon the institutions of society with the same loving concern that, today, we are prone to lavish on the environment.

When we threaten the well-being of these institutions (I include industry) with unreachable or unrealistic goals we are threatening the total well-being of our society!

We are expending massive efforts to legislate environmental protection. In too many instances the legislation attempts to govern the minute details relating to safety, to protection of the environment, and the public. The emphasis, in nearly every instance, seems to be on capturing the violator and taking legal action against an institution.

Recently the American Mining Congress suggested that we should place more emphasis on technology, individual training, and individual responsibility. Quoting from a recent report by that group, "The responsibility for safety lies ultimately with the individual and his supervisor."

It seems to me that these same words are applicable to our ever-increasing concern for the environment. Any way you cut it the president of the company has responsibility for the insulting releases to the environment from that company. However, in the final analysis it is the individual workman who exercises individual responsibility and has a decisive role to play in the prevention or minimization of environmental insults.

Consider the president of a plating factory. He can, in all good faith, establish standards and advocate that his plant will adhere to these standards. However, in the late afternoon a single operator can open a single valve and release the content of a cyanide plating tank to a stream, and in so doing inflict an irreversible insult on the environment.

You don't legislate individual responsibility. You educate for individual responsibility. And that's the game I'm in --- education.

My topic today is Research, Education and the Environment. I'll try to make three points:

(1) That there are many disciplines involved in the search for solutions to our environmental problems;

(2) That the institutions of higher education want to respond to new educational demands, but with moderation; and

(3) That there may be a need for a new product, which I've labeled as an engineering science manager.

Point I - That is that there are many disciplines involved in the search for solutions to our environmental problems.

Einstein, in an address to the Physical Society of Berlin, began with this sentence:

> "In the temple of Science are many mansions, and various indeed are they that dwell therein and the motives that have led them thither." (1)

He, of course was working from the Book of John, Chapter 14, Verse 2, which reads:

> "In my Father's house are many mansions; if it were not so, I would have told you."

At the University of Missouri we maintain a Grant Data Retrieval File. One can access this file by any number of subject areas. I asked the computer for a print-out of all proposals, those pending and those funded, filed under the key-word "environment." I hold in my hand the print-out!

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(1) From "Principles of Research," an address by A. Einstein to the Physical Society of Berlin; published in Essays in Science, Albert Einstein, Philosophical Library, New York, (1934)

This print-out lists 108 total proposals. Fifty-eight of these are active, that is funded, and fifty are pending.

These 108 proposals were prepared by 70 different people from 18 different departments on 4 campuses of the University!

It would be instructional for all of us if I read the title of each of these research efforts, but there isn't time. Instead, let me read to you a list of the departments from which these proposals have originated. My intention is to emphasize the multitude of mansions which comprise the temple of environmental science!

Agricultural Engineering
Agricultural Economics
Agronomy
Chemistry
Chemical Engineering
Civil Engineering
Sanitary Engineering
Electrical Engineering
Physiology
Veterinary Microbiology
Mines and Metallurgy
Nuclear Engineering
Geology
Physics
Business Administration
Biology
Genetics and
Education.

I should add that a number of these proposals are multi-disciplinary and that my print-out only lists the principle investigator and his department.

Point II - that the institutions of higher education want to respond to new educational demands, but with moderation.

I'd like to open this part of my talk by reading the jacket blurb on the book "The Saber-Tooth Curriculum:"

> "research reveals three fundamentals taught to paleolithic children in certain community schools created by a great innovator named New-Fist. These fundamentals were fish-grabbing-with-the-bare-hands, horse-clubbing and saber-tooth-tiger-scaring-with fire. When a glacier caused fish, horses, and tigers

> to disappear, schools nevertheless went on teaching the old fundamentals for the "eternal verities" they contained -- until a few radicals, called progressive educators, succeeded in forcing revisions in The Saber-Tooth Curriculum." (2)

That book was published in 1939! We would hope that educators have become more responsive to change, and more accountable for their actions, in these past thirty years.

But don't expect us to over-respond, only to be responsive!

Let me review, very quickly some recent history, which I believe contributes to our caution.

In 1957 Russia launched a satellite. The public immediately responded with massive infusions of money to engineering and science. The institution, geared up for rapid growth. Graduate enrollment zoomed, departments expanded, new departments were formed, facilities and support services were installed. The educational institutions responded with energy and enthusiasm. The United States caught up and then surpassed all contenders in the Space Race.

Then five years ago the support started to fall away. Basic research has been cut back repeatedly in these past three years. Funding of fellowships and traineeships in 1971 was at one-third the level of 1967. The momentum of engineering and science education has been lost. And, lost with that momentum, is a little bit of the adventurous spirit that inaugurates and nurtures new programs.

I'm saying, gentlemen, that the science-engineering educator will be cautiously responsive to suggestions that the environmental problems require a new breed of cat. Which brings me to --

Point III - that there may be a need for a new product of the educational institution.

Please consider, for a moment, the environmental problems which we address today. How many are "stand-alone" isolated, research problems and how many are complex, multiple-variable, multiple-solution-multiple-effect problems?

Please consider, simultaneously, the talents which we develop in our higher education establishments, and which do relate to our environmental problems and their ultimate solution. And of those mentioned earlier, which are in short supply? Is it the Engineers; Civil, Mechanical, Sanitary, Chemical, or Electrical? Is it the Scientists; Chemists, Biologists, Physicists, or Atmospheric Scientists?

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(2) The Saber-Tooth Curriculum, J. Abner Peddiwell, Forward by Harold Benjamin, McGraw-Hill, New York, (1939)

I suggest to you that it is none of these! I would suggest to you that we are falling short in the production of engineering-science managers; people trained to identify, isolate, study and integrate the multi-faceted complexities of our environmental problems.

We need people trained to integrate the "stand-alone" research efforts into the total picture; isolating and identifying subparts of the whole not now receiving the requisite attention.

These people should be trained to recognize the political, social, economic, and yes, human, actions and reactions to new science or new technology.

These people must be trained to use, not just the scientific approach to problem solution, but the most modern concepts and techniques applicable to the scientific approach. I refer to systems analysis, to Pert methods, to computer modeling of processes and variables, and to many more very sophisticated techniques.

These people must be trained to function as the bridge between the diverse disciplines which must provide the pieces and parts of the total solutions.

You can ask, "Is there such a "discipline," in the higher education institution?" Maybe the Deans of Engineering would answer, "Yes, our Industrial Engineering - or our Engineering Management courses cover these subject areas." Maybe I'm suggesting a new breed of cat. A "generalist" of high order.

(What I am really doing, under this sub-item of Point III, is providing a ready-made jumping-off place for Dean Bill Kimel! He will talk to you tonight on the subject, "Engineering Education: Preparation for the Environment.")

Conclusion

The topic has been Research, Education, and The Environment.

The research for solutions to our environmental problems involves people from many and diverse disciplines.

The educational institutions will be cautiously responsive to pressures to remodel.

There may be a need for a new product from our educational institutions. One which we might identify as an Engineering - Science Manager.

ENVIRONMENTAL IMPACT STATEMENTS AND THE ECOLOGIST

By

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To place some sort of boundary on this discussion I attempted to define the words impact, ecology and ecologist, and assumed that everyone has a reasonably comfortable feeling about the word environment. My dictionary gave three slightly different definitions of the word impact. The first was "the striking of one body against another." While there appeared to be some relationship between this definition and the use of the word as in Environmental Impact, it was not quite what I was seeking and read on. The second definition given was "an impinging: the impact of light on the eye." This placed me in a quandry. The impinging part seemed to be about what I wanted but the last part bothered me because it seems that Environmental Impact Statements often generate more heat than light. So, I read on. The third and last definition of the noun form of the word was "an impacting, forcible impinging: the tremendous impact of the shot." This last definition also had some elements of what I was looking for but it still did not quite satisfy. So, I decided to let you make your own choice of these three definitions and try to define the word ecology.

The definition of ecology that seems to be most widely accepted is that from Eugene Odum's book Fundamentals of Ecology in which he states that ecology is the "study of the relation of organisms or groups of organisms to their environment" or alternately "the science of the interrelation between living organisms and their environment." That seems to be a reasonably tight definition but an equally definitive definition of the word ecologist is at least much more difficult, if not impossible.

Presumably, an ecologist is someone who studies the interrelationship between living organisms and the limits imposed upon them by the interacting physical and chemical components of the environment. Prior to April of 1970 the ecologist was that odd individual who talked about nutrient cycles and food webs and subjected organisms to a variety of different conditions to evaluate their tolerence of environmental variability. At that time there were, in addition to ecologists, a variety of naturalists, conservationists, preservationists and biologists of many different types. After Earth Day One almost everyone was an ecologist regardless of his previous specialization. This led to the current situation where many of the original ecologists are issuing statements decrying the activities and statements of the "ecologists-come lately." But, it should be noted that most of those with a history of doing good ecological research have held themselves somewhat above current environmental arguments and, in fact, have been most reluctant to speak to contemporary environmental issues.

Whatever the qualifications of the "ecologists-come-lately," at this time it is not difficult to find people who will discuss at length the various pros and cons of any activity which in the slightest affects the environment. As long as it remains communication and does not become rhetoric, such discourse serves as a valuable forum forcing us to make some evaluation of the degree of environmental insult we are willing to tolerate to complete a project which meets a demand of society. This sort of evaluation is the first tentative, and perhaps painful step, toward management of the environment for the greatest good of all, which presumably was an underlying objective of the National Environmental Policy Act of 1969. But, we seem to be faltering at this first step.

One reason for our apparent hesitance is our decided lack of knowledge of the many interacting checks and balances which control both the native and man-altered ecosystems. From experience we know the gross environmental degradation which results when we completely over-ride the natural balancing mechanisms of the environment, but to minimize such damage we must gain a much better knowledge of the many environmental intricacies. The second reason is that without such knowledge we are forced to operate from the basis of educated guess which in too many cases reflects our individual prejudices and biases. The third reason is a shortage of well-trained ecologists.

Since we all develop a set of biases based on our experience and training, I would like at this point to give you an idea of my experience and training. I have a degree in fish and wildlife management, two degrees in limnology and eight years experience teaching aquatic biology and aquatic ecology to graduate students in sanitary engineering. I think I have some understanding of the subtle intricacies involved with aquatic ecology but profess no real expertise in terrestrial ecology. My biases will not be stated but probably will be obvious from what follows.

One of the greatest environmental impacts in our history was that associated with settling of the American West. From the journals of the early mountain men and explorers we read of grass which reached a horses belly and of vast herds of bison and elk. But, these same journals also reflect the prejudices of the men who wrote them. For them the environment was ruined by an influx of settlers into the wild region they had come to consider theirs. These early settlers had never heard of ecology but they knew that they must carve out a niche; which to them meant changing the habitat by controlling the indiginous population and the natural output of the land. The first was accomplished by warfare and the near extermination of the bison while the latter was done with the plow. Those animals which could adapt did and those which could not remain as protected remnant populations - the Americal elk is now found in the alpine regions of the Rocky Mountains and the American bison is found in protected herds.

While things like the dust bowl of the 1930's have indicated the consequences of land mismanagement complicated by the vagaries of nature, few would deny that the current agricultural largess from this land is worth the impact on the original environment. Although there is some concern that in addition to losing the wilderness our increasing attempts to maximize agricultural efficiency are resulting in a loss of wildness as well.

An environmental impact statement written in 1850 could not possibly have foreseen the tremendous increases in agricultural efficiency associated with the massive growth in technology which has occurred in the past 120 years. There are those who say that the usefullness of current environmental impact statements will suffer from the same lack of clairvoyance and that future advances in technology will void many current concerns. However, in 1850 the amount of land available appeared to be inexhaustable and management mistakes did not seem too painful. That no longer is true, and that we must manage land for mutual benefit is becoming increasingly clear. It is toward this end that the environmental impact studies and statements have the most to offer if they are conducted and handled in the proper manner.

In this area of the country the three areas of environmental interaction which seem to cause the most concern are the production of electrical energy, the disposal of municipal and industrial wastes, and the management of water through the construction of dams and river channelization. These three areas of activity can be used to demonstrate many of the problems associated with the current preparation, evaluation, and application of environmental impact statements.

The production of electrical energy presents a many faceted environmental problem. If the source of the energy is coal, the coal must be mined. Acid water from shaft mines deteriorates water quality but one of the greatest environmental insults currently practiced is the strip-mining of coal. The environmental deterioration associated with the strip-mining of coal is sufficiently well known that a presidential contender has made an issue of it, but we still talk of writing statements of the environmental impact of strip-mining. Unless there is real effort made to regrade to original contours, to cover acid-bearing spoils, and to revegetate the land it seems pointless to prepare such statements based on surveys of the land before mining. The impact on the land and the drainage streams is total, and, presumably from prior studies we know, at least roughly, the original worth of the land stripped either as farmland or as a site for recreation. Any ecological subtleties associated with such land use are directly related to the effort expended to return the land to a productive use of some kind.

The high sulfur content of coal is accompanied by the spectre of air pollution and nuclear power is suggested as a means of meeting society's expectation for an increased energy supply. Questions of reactor safety and the possibility of contamination by radionuclides are peculiar to the nuclear reactor but the problem of economical disposal of waste heat is shared with coal-fired power generation. The most economical means of heat disposal is to existing watercourses but such activity appears to have a variety of direct and subtle effects on the aquatic environment. Increased temperature of water leads to an increase in biological activity until the water temperature exceeds the physiological tolerance of the individual organisms. Bioassays can be conducted to determine the direct tolerance for heat possessed by the fish and at least some of the other members of the aquatic community. But, such direct measures of single components of the ecosystem do not include the variety of more subtle interactions which control the ecosystem. An example of such subtleties is seen in some recent tentative evidence which indicates that a rise of a few degrees in the temperature of western rivers will cause problems to the salmon - not because of direct physiological damage to the salmon but because increased temperature will cause salmon parasites to be much more active. This is an ecological subtlety, but it is such subtleties which if ignored or unknown are apt to cause us the most harm in the long run. An environmental impact statement replete with detailed lists of current and expected populations of organisms based on field surveys and bioassay data in many instances only explains the obvious. It is an understanding of ecological subtleties and consideration of their affect on environmental response associated with differend land and water use patterns that will allow us to truly evaluate environmental impact.

Disposal of wastes is another problem which affects all portions of the environment. Discharge of liquid wastes to watercourses can upset the aquatic system, incineration of solid wastes causes problems with air quality while disposal in landfills can result in alterations in both the ground water and surface water in addition to being another significant demand for land. Perhaps one of the best examples of the problem is seen in attempts to treat and dispose of municipal waste water. We employ biological-based waste water treatment facilities to convert water pollutants to a solid material descriptively referred to as sludge. One solution to sludge disposal is incineration. With the control of the resulting air pollution by water scrubbers we have, by a significant expenditure of energy, sequentially converted a water pollution problem to a solid waste, then to an air pollutant and finally back to a water pollutant. What is the impact of this activity on the environment? What is the relation between this activity and the environmental impact of energy production? Clearly there are many interactions between the various attempts to meet societal needs while attempting to maintain a quality environment. Those environmental impact statements dealing with attempts to improve the environment in many ways will be the most difficult to write.

Liquid waste discharge has many affects on the ecology of the receiving water, but the degree of harm done in each case is associated with the type and amount of waste discharged relative to the physical, chemical, and biological characteristics peculiar to the receiving water. The marked decline in biological diversity related to dissolved oxygen depletion associated with the discharge of large amounts of biodegradable organic matter to natural waters is well known, but the subtleties associated with plant nutrient discharge and eutrophication are not well established. There appear to be several incongruities associated with demands for nutrient removal from wastewater. Results observed in Lake Washington indicate apparent improvement of this lake associated with complete removal of wastewater discharge to the lake even though the wastewater contributed only about 50 percent of the total phosphorus input to the lake. This suggests that phosphorus removal from municipal and industrial wastes may be sufficient, at least for some lakes. But, it does not mean that all municipal and industrial wastes immediately should be subject to phosphorus removal. Benefits to be gained from phosphorus removal from the municipal wastes of Kansas City appear to be something less than minimal. In this case the muddy Missouri River is the receiving stream and the light limitation imposed by the turbidity would make the probability of excess algal production in the river about equal to that of a good corn crop in a root cellar.

Again it is the interactions which must be considered. Statements about the environmental impact of wastewater discharge must consider the interactions specific to the ecosystem in question. There is little likelihood that environmental impact statements based on generalities will enjoy universal applicability.

Construction of reservoirs and structures to maintain fixed river channels share the objective of controlling water quantity but concomitant alterations in water quality and some aspects of the impact on land use historically have received little attention. Regardless of whether the reason for construction is flood control, hydroelectric power generation, navigation, recreation or water supply; construction of a large reservoir is accompanied by a significant environmental impact. In the portion of land covered by water in the impoundment the environmental impact is total in that a terrestrial ecosystem is replaced by an aquatic system. The decision to build a reservoir is based on a variety of environmental, economic, social and political factors where these other benefits are weighed against those of the existing terrestrial system; but too often interest wanes after the reservoir becomes accomplished fact and little emphasis is given to plans for management of the new aquatic system.

Often it is considered desirable to leave standing trees in the reservoir as fish cover to allow the explosive increase in the fishery. At times such management attempts cause future difficulties. An example of where expectations and desires did not coincide with the biodynamics of a large impoundment is seen in Table Rock Reservoir in south Missouri. Terrestrial vegetation was left in the impoundment and today the lake supports a popular, productive bass fishery. In addition, this reservoir is deep enough that it remains thermally stratified throughout the summer and discharges cold water at all times of the year to Taneycomo Reservoir downstream. This allowed establishment of a very popular cold water rainbow trout fishery in Taneycomo in an area of the country where rainbow trout do not occur naturally. However, during the late summer and early fall, the cold water discharged from Table Rock contains a depressed dissolved oxygen concentration low enough to stress trout. The cause of the low dissolved oxygen levels is bacterial utilization of oxygen as they attack the terrestrial vegetation left in the deep, cold regions of Table Rock Reservoir. In retrospect what was good for the bass fishery in the lake is deliterious to the downstream trout fishery. This is another subtlety for which the cure of the problem appears to be aeration of water discharged from Table Rock during the late summer and early fall - an operation which represents another expenditure of energy.

An example of a potential management problem associated with reservoir construction also is found within the state of Missouri. A recent legal action dealt with the environmental impact associated with the construction of Truman Reservoir with most attention being given to the impact on land use, archeological sites, and fish populations. Another area of concern is the effect of this impoundment on the existing Lake of the Ozarks.

Development of the shoreline of this lake has been extensive and the heavy recreational use these facilities receive undoubtedly produces considerable waste material. Topography of this lake basin is such that most of these wastes remain near the lake with perhaps significant but unknown amounts of plant nutrients associated with these wastes entering the lake. The often turbid nature of the water entering the reservoir provides a light limitation of the growth of both algae and higher aquatic plants. Depending on the nutrient content of the lake water and that of the inshore bottom sediments, both apparently unknown, clearing of the turbidity from the water may result in an explosive increase in aquatic vegetation. Such clearing will occur in the Osage River arm of the lake when Truman dam is completed.

This dam lies within the impoundment of Lake of the Ozarks and will discharge cold water with a low dissolved oxygen concentration during some periods of the year. This cold, deoxygenated water will move along the bottom of Lake of the Ozarks to Bagnell Dam, probably yielding a decreased dissolved oxygen concentration in the lower strata of the lake. Oxygen resources within the reservoir would be severely challenged by bacterial utilization of any additional vegetative biomass. In this case the subtlety which may cause problems is simply clearing the water of inorganic turbidity.

Construction of wall dikes, levees, and other such structures also have an impact on the environment, but here the impact is reduction in environmental diversity with a resulting loss of wildness. The channeled stream obviously represents a significantly narrowed habitat with a concomitant reduction in the types of organisms which can live there. The low-lying land protected from flooding by such structures is rapidly cleared and put into agricultural production, or in some instances, becomes building sites for industrial or residential use. In either case, the clearing of the native brush, trees, and other vegetation represents a loss of diversified wildlife habitat and a consequent loss of wildness.

To an ecologist any ecosystem is controlled by an intricate set of interacting physical, chemical, and biological variables with the exact nature of many of the more subtle interactions remaining unknown. While it is true that a large change in a single component may lead to a gross upset of an ecosystem, native ecosystems by their very complexity possess a significant amount of homeostasis. Although this allows an ecosystem to maintain some degree of balance when challenged by new and different inputs, such inputs usually register some alteration of the ecosystem. The need is to gain a sufficient knowledge of the various ecosystems so that man-generated alterations can be limited to those which cause minimal reduction in ecological homeostasis. Each ecosystem has a finite ability to resist change and when the natural homeostatic mechanisms are overcome the ecosystem is destroyed.

The prime hinderance to current successful management of the environment is the lack of knowledge about the inter-workings of natural ecological homeostasis and the relationship of these natural checks and balances to man-induced environmental change. Until such information is available it will be at best difficult and, in some cases impossible, to construct meaningful statements of environmental impact. But, if they are conducted in the correct manner, information obtained from environmental impact statements written before and sometime after completion of the various projects will help fill this knowledge void. This of course assumes that the initial conjectural impact statement is followed by an evaluation of the true impact of the project on the environment. Without such effort we have learned little and the true environmental impact will not be considered in the design of future but similar projects.

To evaluate the worth of environmental impact statements one must consider the intent of the congress. In a recent Science Magazine article Congressman Charles A. Mosher stated that "The National Environmental Policy Act of 1969 was, in effect, a congressionally initiated environmental full-disclosure law. I assume most of you are familiar with its somewhat controversial requirement for 'environmental impact statements' from every agency of the federal government in advance of almost every proposed new action." The question to be asked is environmental full-disclosure for what purpose? Are these impact statements only to serve to protect the vested rights of the various governmental agencies or are they to be used to attempt to minimize environmental damage associated with various construction projects? Are environmental impact statements merely to sit in a file until they are challenged in a court of law? If this is the case, it will be a long while before environmental impact statements are of much worth to the ecologist and then only because scientific data or perhaps opinions of scientists have received legal blessing and are included in the body of environmental law. Who will write and who will review environmental impact statements? Will these people have knowledge of environmental subtlety? These and many other questions must be answered before an ecologist can adequately speak to the question "Environmental Impact Statements and the Ecologist."

If environmental impact statements are used to advance knowledge and are included in project design deliberations they are useful. But if they are only to protect bureaucratic self interest they become a hurdle of indefinite height which must be cleared to get a construction permit and they become a hoax.

A very serious problem in the writing and evaluation of environmental impact statements is a shortage of people trained in the subtleties which control the environment. As a science, ecology is extremely broad and expecting one individual to be knowledgeable about the subtleties involved with the various terrestrial and aquatic ecosystems is analagous to expecting a good criminal defense from a patent attorney, a good bridge design from an electrical engineer, or good eye surgery from a proctocologist. And, on that note I close this discussion of environmental impact statements.

Copies of Mr. Struxness' speech were not available at time of printing. For futher information concerning the speech, we suggest you contact:

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THE ENVIRONMENTAL IMPACT STATEMENT AND CONSTRUCTION INDUSTRIES

By

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There is an old saying that you cannot make an omelette without breaking some eggs. Environmentally, an analogous saying would be, you cannot break ground for construction without having some impact on the local ecology. This point is well understood by most environmentalists. Since January 1970, when the National Environmental Policy Act became law, the prevailing attitude about NEPA has been that it is a cost-benefit statute. Under that view, those who would disrupt any part of the environment should be obliged to demonstrate that the ultimate good to be derived out weighs any impact incurred along the way. A more recent view of NEPA holds it to be an environmental preservation law. Under this view all impacts must be reduced or eliminated regardless of cost and inspite of any favorable balance.

The construction industry can accommodate the first view. However, the second view raises questions which must be answered.

To date, the adverse environmental impacts of construction have been considered to be unavoidable, temporary effects which should be reduced as feasible to the extent practicable. This attitude has been reflected in Government proceedings held in connection with dredge and fill operations on navigable waterways, right-of-way clearing on public lands as well as in other undertakings.

Typical of the impacts considered in connection with major construction projects are the following:

-Whether there will be an increase in the turbidity of surface waters as a result of working on the banks or in the body of water itself.

-Whether there is a potential for erosion from cut and fill operations.

-What consideration has been given to restoration of borrow and spoil deposit areas.

-Whether the operation of a concrete batch plant will create objectionable atmospheric dust or ambient noise levels.

-The necessity for and schedule of blasting operations.

-Burning and disposal of refuse.

Where it can be shown that an impact can be reduced by practical methods, it is appropriate to discuss this.

It is also common to see societal impacts discussed. Any large construction project will have an effect upon the local community. Additional public services will be required. However, increased local commerce as well as added tax income will help pay for the services. Also, such unavoidable impacts as increased vehicle traffic on the roads near the project are discussed.

In each case there traditionally has been an implicit acceptance of the fact that the public must be represented not only as the user of the environment but also as the group ultimately paying the bills for the project. Unquestionably, our commitment to an abundant life has put a high priority on major construction projects. Indeed, the highway improvement program as an example, was one of our nation's highest priorities in the late 1950's.

It is also clear that our attitudes have changed about the environmental price we should pay for our abundance. We all recognize that there is no such thing as an "infinite sink" into which we can put our unwanted by-products. The last two years have shown, however, that thoughtful planning along with the setting of practical goals can lead to an optimization and balancing of ecological and economic interests.

In a recently published guide to the preparation of Environmental Reports, issued by the USAEC for comment, the following language appears:

> "The construction of a nuclear power plant and related facilities will inevitably affect the environment; some of the effects will be adverse. Effects are considered adverse if environmental change or stress causes some biotic population or nonviable resource to be less safe, less healthy, less abundant, less productive, less aesthetically or culturally pleasing, as applicable; or if the change or stress reduces the diversity and variety of individual choice, the standard of living, or the extent of sharing of life's amenities; or if

> the change or stress tends to lower the quality of renewable resources or to impair the recycling of depletable resources. The severity of unavoidable adverse effects should be reduced to minimum practicable levels."

This approach to the impacts of construction represents, I feel, the other view of NEPA; that is, that all impacts should be reduced regardless of cost. This attitude contains fallacious logic as well as practical difficulties. First, great care must be taken not to support the fallacy that all adverse impacts are subject to reduction. This implys that there are alternative actions or methods, when in fact there may not be (short of abandoning the project). Of most importance, however, is the commitment to reduce impact in spite of cost. Where there are alternative actions or methods which may be applied to reduce construction impact, it is usually the case that the alternative increases the cost of the job or increases the time to completion. It should be obvious that if we lose sight of the goal and concentrate, instead, on the way we get there, we may find ourselves delaying urgently needed environmental improvement projects, such as civic sewage treatment improvement programs, while we debate over comparatively insignificant construction impacts.

The citation, made above, of the proposed USAEC guideline is not an extraneous example of what I will call the "new environmental attitude." In the spate of regulations that immediately followed the enactment of NEPA, one saw a concern for man in his environment. Typical of this type of thinking was the enactment of ambient primary and secondary air quality standards in the Clean Air Act Amendments. Those standards recognize the potential harmful effects of pollutants and set limits which take into account practical experience. On the other hand, we have more recently been seeing an increased interest in very strict emission standards for airborne or liquid effluents. These are not related to any particular impact level in the real world but instead are rooted in the philosophy of "make it smaller at any cost." This change in approach has come about subtly, but its effects may be very far reaching.

I expect that even now emission standards for non-point discharges of liquid effluents into receiving waters are being contemplated. These standards would set numerical limits for such things as runoff from major construction projects. In light of the language contained in the new Federal Water Pollution Control Act Amendments, it is likely that the standards will require the use of "best practicable technology" by one date, and the "best available technology" by a subsequent date, to reduce emissions.

The practical difficulty of this "new ecology," when applied to major construction projects, is that meaningful schedules and cost estimates are no longer possible. Consider for a moment a project of the size and complexity of a rapid transit system for an urban metropolis. Here is an undertaking requiring years to complete and financing by public approval of the sale of bonds. How can the taxpayers know the limit of their bonded indebtedness when the methods of construction may be bound by something as nebulous as the "best available technology?"

I wish I could offer you an easy way out of this dilemma, but I can't. It's true that the enforcement of ambient pollution standards causes problems for the regulators. But it is also true that a slavish application of emission standards, without consideration of value to society of the proposed project may work against the public interest.

In the recent session of Congress a proposal was made to establish Consumers Protection Legislation (S 3970 and HR 10835). Now I suspect that the measure, as offered, contemplated little more than the nationalization of the Ralph Nader movement. However, a properly administered Consumers Protection Agency could well serve as a watch dog to assure the whole public interest is considered in the exercise of environmental regulations, and not just those of certain special interest groups. One interesting wrinkle of the proposed legislation is that it would require the preparation of a consumer impact statement. I can envision the time when the environmental impact statement and the consumers impact statement might be considered together as the final benefit/cost assessment of a proposed major action affecting our well being.

Copies of Mr. Hall's speech were not available at time of printing. For further information concerning the speech we suggest you contact:

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TRANSPORTATION INDUSTRIES

By

R. R. WAESCHE

SECRETARIAL REPRESENTATIVE
U.S. DEPARTMENT OF TRANSPORTATION
KANSAS CITY, MISSOURI

The opportunity to be here today to discuss environmental impact statements and the transportation industry is appreciated. I note that the other three individuals included on this panel are directly associated with business interests. As a representative of the Federal Government, I am happy to participate with industry personnel on this most important subject. The Department of Transportation seeks the same objectives as the private transportation sector. That objective is: A healthy transportation industry operating proficiently and profitably, serving the shipper at reasonable rates and the public with maximum efficiency.

The Department is committed to a close working relationship with all of you. The more productive our transportation systems become, and the better we do our job, the greater our efficiency, the richer we will be in the rewards of mobility. The industry and all people will benefit and our nation will be enriched and strengthened.

One of the first things I learned as Regional Representative of the Secretary of Transportation was that America's transportation capacity would have to be doubled in less than 20 years. We fully expect a 300 percent increase in air passenger miles by 1983, a doubling in general aviation hours flown, at least a 50 percent growth in automobile travel, and a tremendous increase in the demand for urban public transporation.

As you know, the location of the earliest major cities resulted directly from transportation considerations. They are generally located alongside natural transportation facilities or termini-rivers or harbors. So the impact of transportation on land use is literally ancient.

Transportation impacts on the environment indirectly as a result of its effect on land use. Each new addition or improvement to a transportation network can have a powerful influence on the location and shape of economic activity and land use, particularly when there are complementary forces at work. This can best be observed in urban areas where the impetus for growth is strongest. The development adjacent to the freeways that have been built here in Kansas City and in other major cities within the past 15 years is a striking illustration of this fact. The development which is already occurring around the new Kansas City International Airport is another illustration of the indirect influence of transportation in shaping urban environment.

Let me turn from transportation's indirect impact on the environment through its effect on land use, and review briefly with you some of the direct air and water quality activities of the Department of Transportation. With respect to air quality, DOT has some shared responsibilities with the Environmental Protection Agency. DOT also has important research under way specifically related to exhaust emissions. The Urban Mass Transportation Administration in DOT has been testing environmental improvement packages on buses. These "EIP" kits have been used on new diesel buses in San Francisco, and old bus engines in other cities have been modified to accept these kits. Recent reports indicate that some success has been achieved in combating smoke, odor, and carbon monoxide. Cities are now asking for Federal aid to purchase buses under the capital grant program which incorporates emission control features.

With respect to water control, the Coast Guard is aggressively enforcing appropriate sections of the Federal Water Pollution Control Act in the marine environment. It has an action program under way to prevent oil spills. Moreover, it is conducting research directed toward controlling oil spills. It is developing hardware to take oil from vessels in distress, to contain oil which is spilled, and to recover it after it has been spilled. (Give examples)

These are a few examples of the directions the Department of Transportation is pursuing directly relating to air and water control in addition to its major efforts to effect air and water control through transportation's impact on land use.

Environmental impact statements are a way of life for the Department of Transportation and its operating Administrations. Environmental considerations receive top priority and they will continue to be carefully analyzed. Environmental impact statements apply to all transportation modes. In the Department of Transportation, the Federal Aviation Administration, the Coast Guard, and the Urban Mass Transportation Administration must meet environmental impact statement requirements. The National Highway Traffic Safety Administration must also develop statements for their annual work programs.

Most of you here today have, no doubt, been directly involved in environmental impact statements prepared for highway and airport projects. Representatives of the Federal Aviation Administration and the Federal Highway Administration are included on your program, and I am confident they will give you a careful and complete rundown on their environmental impact statement procedures. DOT is committed to do a thorough and professional job in the environmental area.

Environmental impact statements are required for all construction projects involving Federal funds. It is important to note that environmental impact statements are not required when industry alone constructs a plant or privately owned property. In the absence of state or local requirements, an environmental impact statement would not be required prior to the construction of a large automobile assembly plant. Federal agencies do, however, work with industry on emission control from factories, assembly plants, and auto, truck, railroad, ship, and aircraft engines even though environmental impact statements are not involved.

We are all familiar with the emission controls being placed on the new automobiles being marketed today. You have heard about the effect these new controls have on automobile performance. (Example)

Additional stringent new environmental standards will be placed on automobile manufacturers for 1976 automobiles. Present automobile engine efficiency will be reduced by 40 percent. This further reduction is in the face of a 20 percent decrease already made mandatory by emission control devices presently in use. This decrease in engine efficiency comes at a time when the nation faces a petroleum crisis which may one day produce a shortage of fuel for these inefficient automobiles. This makes it necessary that common carriers such as buses must take increased passenger and traveler loads because of the buses' more efficient use of fuel. For instance, in Washington, D. C., 200,000 automobiles travel into the city daily. The same number of people could be transported into the city and back to their homes with 6,000 buses, thus reducing pollution and reducing the amount of fuel used.

This emission control--petroleum crisis outlines the need for industry and Government to work closely to address the pollution and resource problems of the nation. We cannot address this as a question of "one-or-the-other," but we need a combined industry-Government effort to develop a transportation system which will adequately serve the needs with a minimum adverse environmental effect.

The protection of the environment means understanding and concern at all levels, and I would hope that Federally funded programs could serve as a model for state and local governmental units. Believe me, there is every desire in the Department of Transportation for our decisions to be responsible ones. We have a mandate not just to provide transportation services, but to integrate those services into other national goals and program objectives. We have a mandate to oversee the expeditious movement of people and their goods, but that mandate also calls for us to pay full attention to environemntal considerations.

My friends, may I reiterate as strongly as possible -- we want to work with you; share your reasonable goals; and we are convinced the challenge can be met.

Again, thank you for inviting me to be with you.

Copies of Mr. Sloth's speech were not available at time of printing. For further information concerning the speech we suggest you contact:

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ENVIRONMENTAL CCNSIDERATIONS OF FOSSIL FUELED POWER STATIONS

By

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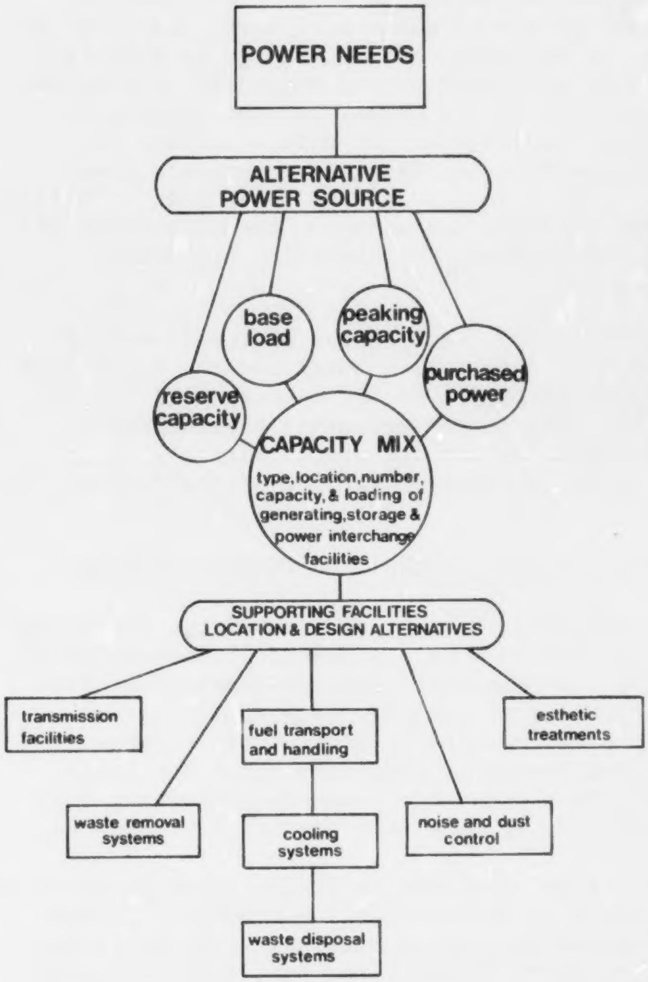
We could say that it is a pleasure to discuss with you fossil fueled generating station environmental reports -- but that would be less than truthful; rather, let's say it is appropriate at this time to strive for a better understanding of environmental considerations that should be given to the siting and design of fossil fueled generating stations.

Federal agencies have published environmental report preparation guidelines, but none are as detailed as the recently proposed AEC guide for an Applicant's Environmental Report on a nuclear generating station. Considerations of a fossil fueled generating station's potential environmental impact are such that only broad general guidance is practicable at this time. The power industry is developing procedures which will improve the quality of impact assessment, and the quality of environmental decisions concerning the location and design of power generating and transmission facilities.

We are both to share some of our insights, and to work toward a consensus among utilities, the regulators, the public, and those citizens called environmentalists, conservationists, or preservationists. The consensus needed is one which will facilitate determination of tolerable environmental impact in the location of, construction of, and operation of power facilities. A particular concern is the clarification and reconciliation of true public interests and avowed environmentalist concerns.

One primary environmental consideration often centers on the need for additional generating facilities to meet growing demands for electric power. Within the framework shown on Figure 1, the utility as a regulated monoply supplier has no viable alternatives to meeting the demand for power. If the growth in demand for power were to be constrained by other than normal economic forces, this would have to be done through major changes in public policy, or by changes in socio-cultural determinants


POWER NEEDS
ALTERNATIVE POWER SOURCE
base load
peaking capacity
reserve capacity
purchased power
CAPACITY MIX
type, location, number, capacity, & loading of generating, storage & power interchange facilities
SUPPORTING FACILITIES LOCATION & DESIGN ALTERNATIVES
transmission facilities
fuel transport and handling
esthetic treatments
waste removal systems
cooling systems
noise and dust control
waste disposal systems

UTILITY DECISION FRAMEWORK

MACRO-ENVIRONMENTAL FACTORS AFFECTING NEED FOR POWER AND POWER SUPPLY

PUBLIC POLICY

ECONOMIC

TECHNOLOGICAL

SOCIO-POLITICAL-CULTURAL

ECOLOGICAL

FIGURE I

of power demand. The utility does not have the prerogative to say: "Those of you who have air conditioners can keep them, but those of you who don't already have one will just have to do without." Although some discriminatory rate policies have been proposed to limit power demands, a utility's basic objective should be to do their best to provide power to each customer at a rate which will cover the "cost of service" to that customer. If one class of customer is to subsidize another class of customer, then this rate policy should be so directed by the rate regulating authority. In any event, we have assumed in our discussion that electricity is vital to the public welfare and that the utility, as a sole supplier, is obligated to satisfy power demands of the public. The task is to provide the power and to balance socio-environmental costs and benefits accompanying the generation and distribution of electricity, through due consideration and proper assessment of potential impacts.

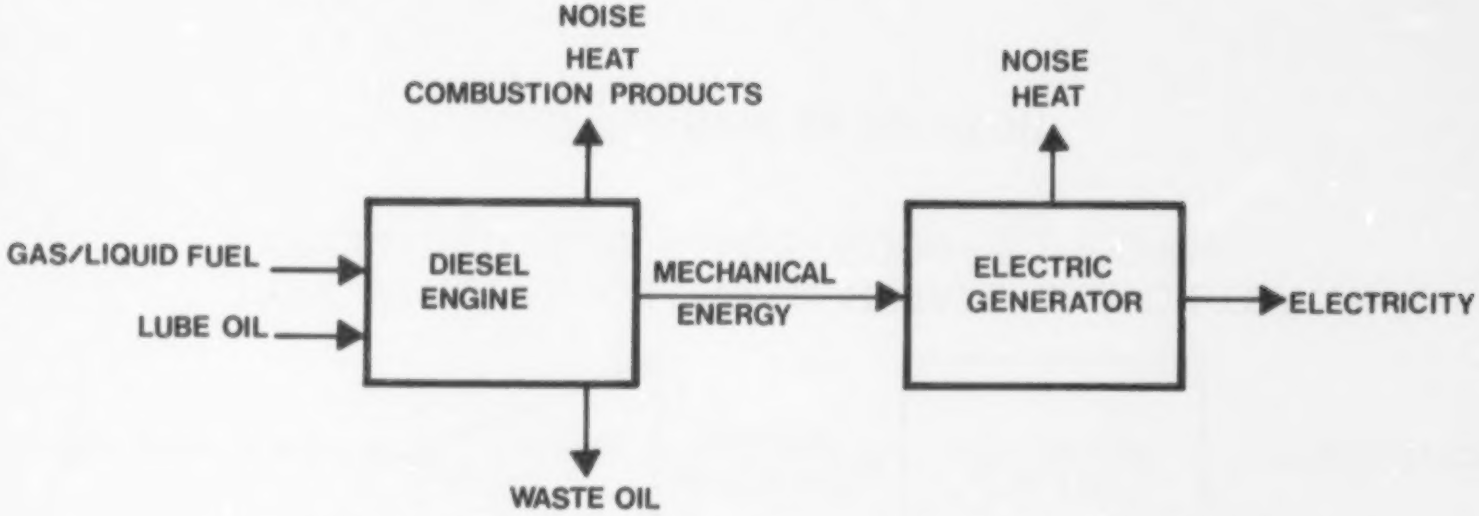
We will now briefly describe some major types of fossil-fueled generating facilities in order to establish a basis for the discussion of environmental considerations pertinent to power station siting and design. We will then consider some of the potential environmental impacts and the alternative locations and designs to mitigate these impacts. The decision framework to consider various siting factors is shown on Figure 1.

SUMMARY DESCRIPTION OF FOSSIL FUELED ELECTRIC GENERATING METHODS

Diesel engines are the smallest type of prime mover regularly used for primary power production. Figure 2 is a schematic illustration of a diesel generating unit. The largest units available are about 7000 kW and these are used for primary power only on very small systems. Diesels are also used as quick start units to protect remote power loads or to provide startup and emergency auxiliary power for large generating stations. Diesels have good efficiency in converting fuel into mechanical and electrical energy, but they require a premium fuel.

Gas turbines are commercially available in larger sizes up to 60,000 kW. Figure 3 is an illustration of the gas turbine concept. In the smaller sizes gas turbines can be applied to the same services as the diesel engine. For continuous duty, however, the heat rate is higher than that for a diesel engine, making fuel costs even greater. Gas turbines offer the advantages of rapid response in use, and of low initial cost. They are, however, expensive to operate, thus they are best suited and mostly employed for peaking and reserve power requirements.

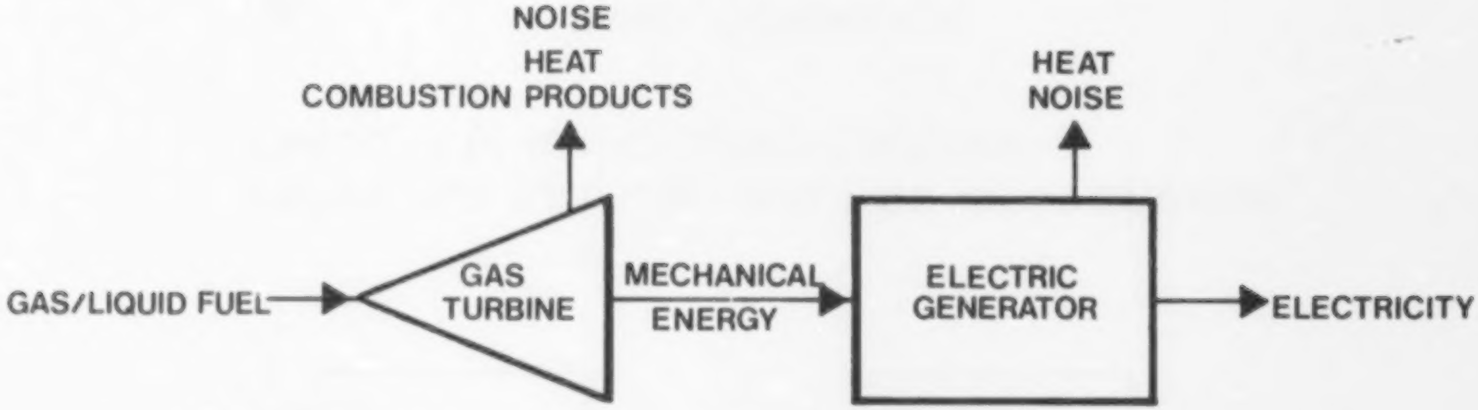
High quality fuels are used in both diesel engines and gas turbines, and neither requires significant qualtities of cooling water. Furthermore, both gas turbines and diesels constitute a small fraction of electric energy generated in a typical system. Consequently, these methods of power generation have small potential environmental impact.


NOISE
HEAT
COMBUSTION PRODUCTS
NOISE
HEAT
GAS/LIQUID FUEL
LUBE OIL
DIESEL ENGINE
MECHANICAL ENERGY
ELECTRIC GENERATOR
ELECTRICITY
WASTE OIL

TYPICAL NET FULL LOAD HEAT RATE 10,000 BTU/KWH
TYPICAL SIZE RANGE 2,500–7,000 KW

DIESEL GENERATION

FIGURE 2


NOISE
HEAT
COMBUSTION PRODUCTS
HEAT
NOISE
GAS/LIQUID FUEL
GAS
TURBINE
MECHANICAL
ENERGY
ELECTRIC
GENERATOR
ELECTRICITY

TYPICAL NET FULL LOAD HEAT RATE 12,000 BTU/KWH
TYPICAL UNIT SIZE RANGE 5,000-60,000 KW

GAS TURBINE GENERATOR

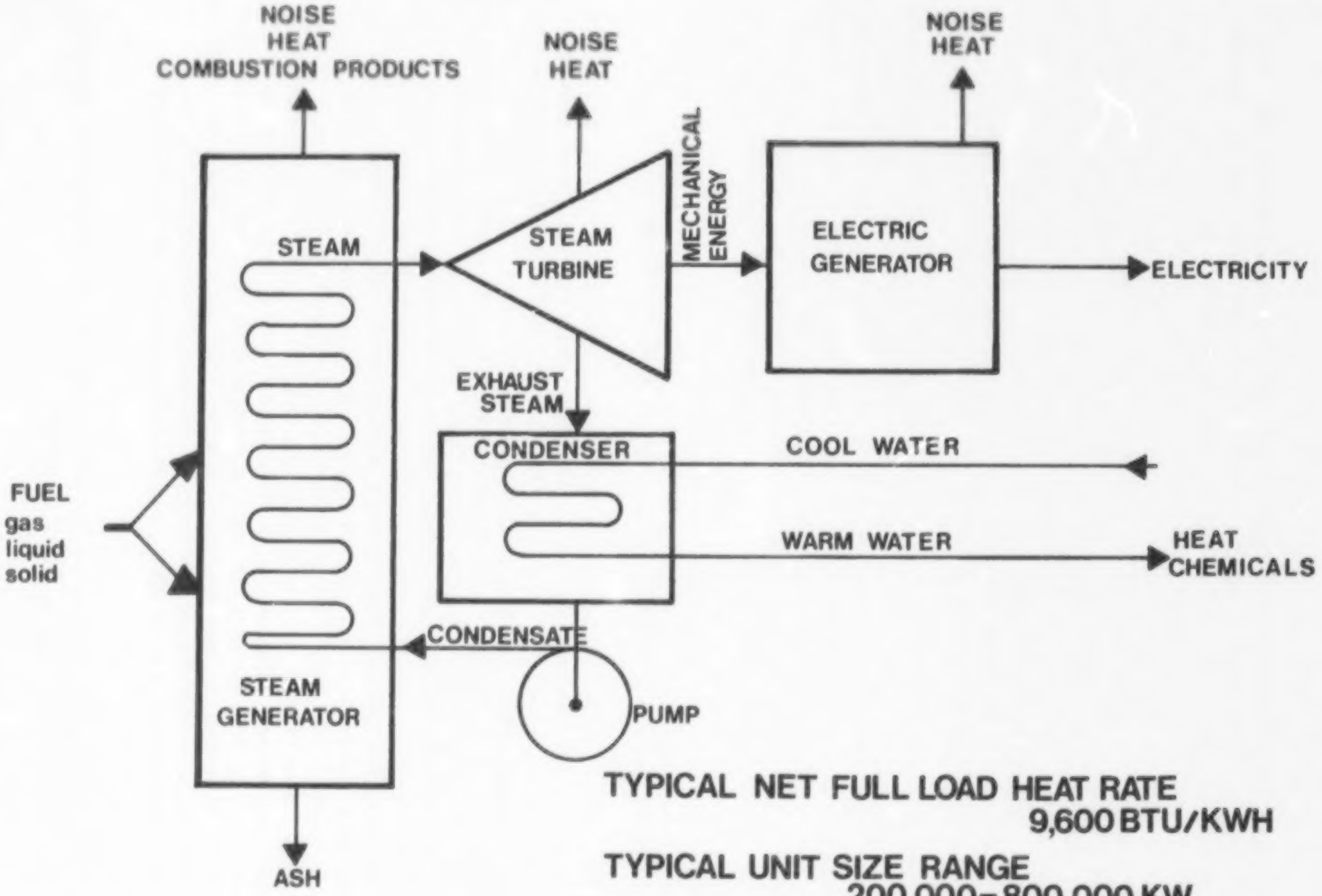
FIGURE 3

The most prevalent form of electrical generation consists of fossil fuel burning steam electric units. In this process, the fuel is burned in a steam generator, and the steam is used to drive a turbine. This cycle is illustrated on Figure 4. Steam electric capacity is the most widely used method for continuous duty, base load electric generation. Fuel can be solid, liquid, or gas, or even combinations of fuel types. Generating units with capacities in excess of 1,000,000kW are increasingly common. Steam conditions range up to a pressure of 3500 psi and a temperature of 1000 F. Because of low fuel quality requirements, the need for substantial quantities of condenser cooling water, and typically large capacity, steam electric units have, in comparison to other types of generating capacity greater potential for environmental impact.

A combined cycle plant is, as its name implies, a hybrid arrangement of generating cycle types. The combined cycle process is illustrated on Figure 5. It utilizes the heat exhausted from a gas turbine to generate steam which drives a steam turbine to achieve efficiencies which are more or less equivalent to those obtained with the high pressure steam cycle. This concept includes the optional use of auxiliary fuel to generate steam. A substantial disadvantage of this type of unit is that the fuel is limited to gas or oil. Single unit combinations (one gas turbine and one steam turbine) are available in sizes up to about 100,000 kW. Combinations have been planned, using multiple gas turbines and a single steam turbine, having a total capability of about 400,000 kW.

It is interesting to compare the thermal efficiencies and heat balances of fossil fueled and light water nuclear fueled steam electric units. As can be seen on Figure 6, the thermal efficiencies of a nuclear unit and a fossil unit using low grade coal are nearly the same. Consequently, the total amounts of nonproductive, or waste, heat rejected to the biosphere are also nearly identical. A nuclear unit does not reject much nonproductive heat directly into the atmosphere, rather it rejects heat through the steam condenser into cooling water which subsequently gives up its heat to the atmosphere. In a fossil fueled unit, thermal radiation and exhaust gases of fuel combustion carry about one fourth the total nonproductive heat directly into the atmosphere. Nearly all of the remaining waste heat is rejected through the steam condenser. Typically, a fossil unit will reject 30 percent less heat to cooling water than will a comparable nuclear unit. In every case, however, it may be worth noting that all of the heat obtained by burning fuel -- fossil or nuclear -- is soon transferred to the environment somewhere along the generation-transmission-utilization pathway.

We now turn to a discussion of power station environmental impacts and alternatives to mitigate those impacts.

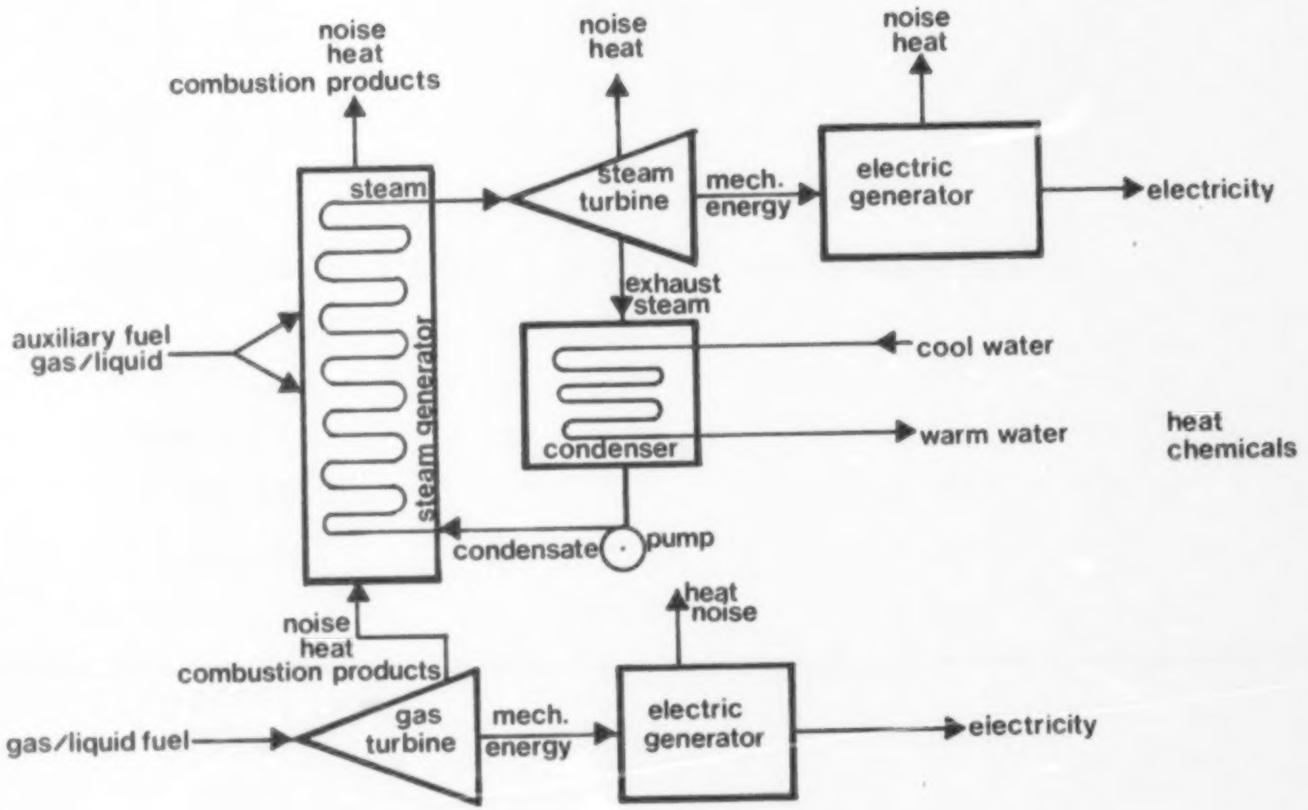

NOISE
HEAT
COMBUSTION PRODUCTS
NOISE
HEAT
NOISE
HEAT
STEAM
STEAM
TURBINE
MECHANICAL
ENERGY
ELECTRIC
GENERATOR
ELECTRICITY
EXHAUST
STEAM
CONDENSER
COOL WATER
FUEL
gas
liquid
solid
WARM WATER
HEAT
CHEMICALS
CONDENSATE
STEAM
GENERATOR
PUMP
ASH

TYPICAL NET FULL LOAD HEAT RATE
9,600 BTU/KWH

TYPICAL UNIT SIZE RANGE
200,000–800,000 KW

STEAM ELECTRIC GENERATION

FIGURE 4


noise
heat
combustion products
noise
heat
noise
heat
steam
steam turbine
mech. energy
electric generator
electricity
auxiliary fuel gas/liquid
steam generator
exhaust steam
cool water
warm water
heat chemicals
condenser
condensate
pump
heat
noise
noise
heat
combustion products
gas/liquid fuel
gas turbine
mech. energy
electric generator
electricity

TYPICAL NET FULL LOAD HEAT RATE: aux. fuel 9,500 BTU/KWH
no aux. fuel 8,800

TYPICAL UNIT SIZE RANGE 100,000-400,000 KW

COMBINED CYCLE GENERATION

FIGURE 5

ELECTRIC GENERATION
ENERGY BALANCE

THERMAL EQUIVALENT (BTU)	FOSSIL	NUCLEAR
INPUT	9.600	10.413
ELECTRICITY	3.413	3.413
COOLING WATER	4.987	7.000
CHIMNEY	1.200	-0-
EFFICIENCY	36%	33%

COMPARISON OF FOSSIL & NUCLEAR STEAM GENERATION

FIGURE 6

POWER STATION ENVIRONMENTAL IMPACTS AND ALTERNATIVES TO MITIGATE IMPACTS

Planning of power system capacity requirements is a complex function of many variables. Figure 7 illustrates the capacity planning framework. Load requirements are supplied by providing a suitable mix of capacity and power interchange facilities dedicated to meeting base load, peaking, and reserve requirements of the system. Although capacity dedicated to meeting base load requirements may constitute only 50 to 70 percent of total installed system capacity, it usually accounts for more than 85 percent of total electric generation within the system. Base load capacity therefore constitutes the primary source of a generating system's potential environmental impact. Base load capacity is predominantly steam electric and we will restrict the remainder of our discussion to fossil fueled steam electric generation environmental impacts.

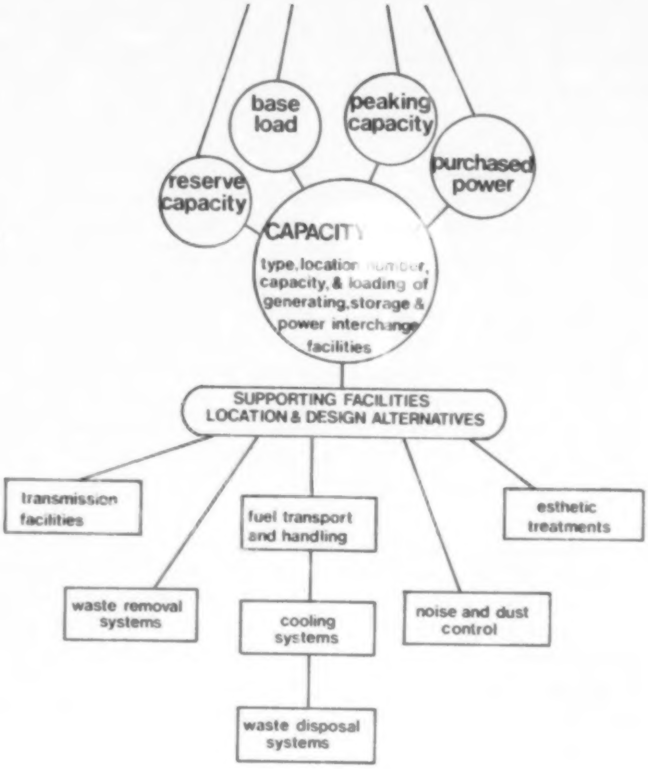
The location of a generating station and the design of nearly all of its major facilities are affected by the fuel selected. Fuel selection is also one of the most significant determinants of environmental impacts. Principal fuel selection criteria are fuel quality, availability, and cost. In the past, fuel cost and availability were given top priority in fuel selection; fuel quality was the factor next in importance. The recent promulgation of a wide range of environmental quality control regulations, coupled with the limitations in the supply of certain fuels, has brought about a reordering of the priorities for seclection criteria. Fuel quality is becoming most important; fuel availability is next in importance, and fuel cost is subservient to other selection factors.

A closer examination of the relation between fuel quality and power station environmental impact provides some insights into the preeminence of the fuel quality criterion over other fuel selection factors. There are two measures of fuel quality that are especially relevant to environmental impact assessment. These are 1) fuel heating value expressed as British thermal units per unit of fuel weight or volume, and 2) fuel sulfur and ash content expressed as pounds per million Btu of fuel heating value.

The lower a fuel's heating value, the greater is the quantity of fuel required for a given energy generation. Fuel heating value is thus an environmental consideration, since the magnitude of environmental impact caused by fuel processing is strongly linked to the quantity of fuel produced, transported, and utilized. Therefore, to some extent, the higher a fuel's heating value, the less potential environmental impact associated with its processing and use for electric generation.

PLANNING CONSTRAINTS

- ° commercial generation & transmission technology
- ° environmental quality control regulations
- ° commercial pollution control technology
- ° fuel availability & costs
- ° location & siting factors
- ° capacity availability
- ° reserve requirements
- ° system demand characteristics
- ° potential environmental impacts


reserve capacity
base load
peaking capacity
purchased power
CAPACITY
type, location, number, capacity, & loading of generating, storage & power interchange facilities
SUPPORTING FACILITIES
LOCATION & DESIGN ALTERNATIVES
transmission facilities
fuel transport and handling
esthetic treatments
waste removal systems
cooling systems
noise and dust control
waste disposal systems

CAPACITY PLANNING

FIGURE 7

Another measure of fuel quality which is important to environmental considerations is the quantity of fuel byproducts emitted per unit of fuel heating value. This measure is more relevant to environmental impact assessment than is the weight or volume percentage of, for example, sulfur or ash in a fuel. To illustrate, a fuel low in sulfur by volume or weight and with a low heating value may produce a higher percentage of sulfur byproducts than is at first apparent when compared to "high sulfur" fuel with a high heating value -- simply because a greater quantity of low heating value fuel is required. Similarly, the quantity of byproducts emitted from an 85 percent removal system using high sulfur fuel may be greater than those emitted from a 50 percent removal system using low sulfur fuel.

When selecting a fuel for any given level of power generation, there often must be some tradeoff of 1) fuel heating value or quantity of fuel, 2) the quantity of fuel byproducts per unit of fuel heating value, and 3) the quantity of unwanted fuel derived substances removed. This tradeoff is subject to constraints of fuel as well as plant capital and operating costs.

Recently adopted air quality control regulations governing fuel sulfur content, and emission levels of combustion product and particulates - have escalated demands for low sulfur fuel such as natural gas and light fuel oil and for higher performance particulate removal systems. These developments have also contributed to dramatic changes in fuel economics and marked shifts in the geographics of fuel production and consumption. High sulfur midcontinent coal resources have declined in availability and use as future fuel supplies. Midcontinent natural gas and supplies are being preempted for non-electric generation uses. Utilities in this region are becoming increasingly concerned with the availability and security of suitable fuel supplies -- at any reasonable cost. During the last two years, utilities have been looking to supplies of low sulfur, low heating value western sub-bituminous coal as fuel for future base load generation. Utilities have also been sponsoring research and development of sulfur removal processes to extend the utilization of high sulfur fuels. Use of western coals in the mid-central region involves either transmission of power over long distances, if generation occurs near the mine, or the transportation of coal over distances of many hundreds of miles to the mid-central region power stations.

A typical, future mid-central power station with a 2,000,000 kilowatt capacity, may require about 175,000 tons of western coal during one week. Coal deliveries of this magnitude utilize large unit trains, of about 100 railroad cars, each holding 100 tons of coal. Such 10,000 ton capacity unit trains are over one mile in length.

Potential environmental impacts produced by strip mining have recently become the subject of mounting environmentalist concerns.

Because potential fuel logistical problems are compounded by increased transport distance and other worsening supply factors, stockpiling several months supply of primary fuel at the power station is required. Increased fuel storage involves more fuel handling and storage facilities accompanied by greater costs and higher potential environmental impact.

If it is assumed that low grade western coal will be used increasingly in mid-central region power stations, what other environmental considerations are involved in the design of station facilities? The primary environmental considerations would be related to fuel quality factors as they affect the designs of air pollution, wastewater, and solid waste control systems. In addition, thermal discharges discussed in other conference papers, transmission facilities, station esthetics and station construction activities would all have potential environmental impacts.

The air pollution control system largely determines the nature of the fuel related wastewater and solid waste control systems. Air pollution control reduces the emissions of particulate matter, sulfur dioxide and oxides of nitrogen into the atmosphere. Emission reductions of these substances are constrained by technology, economics, regulatory requirements, and potential environmental impacts caused by the liquid and solid wastes accompanying sulfur dioxide and particulate removal.

Oxides of nitrogen (NO_x) emissions are reduced by combustion process controls affecting nitrogen oxide (NO) production. Although significant progress is being made in the design of new steam generators, the technical problems involved in significantly reducing nitrogen oxide formation are formidable. To date, no removal concept for oxides of nitrogen has been demonstrated as practicable, and control has been limited primarily to improvements in steam generator combustion process design.

Removal of particulate matter is often accomplished by electrostatic precipitators which can remove in excess of 99 percent of particulates. A conventional "cold" precipitator will not be as effective in removing particulates if the sulfur content of the combustion products is low. The presence of sulfur reduces the particulate resistivity, and thereby facilitates electrostatic charging of particulates required for collection. Precipitator performance can be improved by operation at high temperatures which incurs a considerable cost penalty.

There are many sulfur dioxide removal processes in various stages of experimental development. The most extensively tested processes involve wet scrubbing of flue gas with lime of limestone slurries. The removal agent (limestone) can either be injected into the steam generator furnace or be introduced into the scrubber. There are several types of flue gas scrubbers including the packed bed, with packing which may be plastic balls, marbles, or a grid and other types such as the tray, spray tower, or venturi. Solid and liquid byproducts of sulfur removal operation contain sulfur compounds and particulate matter mixed in a slurry with some unreacted limestone.

Large quantities of water, raw materials, and energy are consumed by these removal systems. When material is removed from the flue gas it is either dissolved in a liquid or is transformed into a solid -- it doesn't "disappear." These dissolved and undissolved materials must somehow be handled so that the potential impacts on the environment is tolerable and acceptable.

POWER STATION SITE SELECTION AND THE ENVIRONMENT

The number of sites that seem to be acceptable today is diminishing due to technical, economic, environmental, regulatory and public considerations. As a result we will probably be planning larger stations at any one site. Some sites that are apparently unacceptable today will probably have to be used in the future as otherwise physically suitable sites will not be available. A more detailed analysis and documentation of the site selection processes will probably be required to justify the use of these sites.

The recent National Academy of Engineering Study on Power Plant Siting, emphasized that "plans for siting should be made years in advance, that there should be early public participation, and that utilities must gain public trust by use of complete and open information." In our opinion, this recommendation presumes that full public involvement should be forestalled until basic system planning is completed, candidate sites have been selected, and the technical, economic and environmental evidence relevant to the project have been developed.

It seems to be in vogue today to go to great efforts to involve the public or their quasi-representatives in the site selection process. This requires that the utility:

1) Screen a large number of potential sites to a few apparently acceptable ones - usually less than ten.

2) Educate the public representatives on social, economic, technical, and environmental fundamentals of power plant site selection.

3) Assist the public representative (as they may require) to evaluate the total impact to arrive at: a) a listing of those sites that are not acceptable at this time, b) a ranking of the acceptable sites for final decision by the utility.

During the site selection process it is advisable to obtain criteria from responsible regulatory agencies from which permits are required, and keep agencies abreast of the selection process.

It is necessary to prepare a preliminary environmental evaluation on each of the apparently acceptable sites so that the basis for the final selection will be documented insofar as environmental considerations are concerned. This ensures environmental factors as well as technical and economic factors are considered in site selection.

Assessments of potential environmental impact and substantiating documentation are now an integral part of the power business. Documentation of environmental considerations given in the siting and design of power facilities is needed to:

1. Ensure compliance with regulatory requirements.
2. Adequately present environmental considerations of station design alternatives.
3. Provide considerations of alternative sites and rationale for the final selection.
4. Provide considerations of the various practicable alternatives considered to mitigate the effects of the plant on the environment.
5. Provide documentation of plans to obtain base line information for future evaluations of actual rather than theoretical environmental impact.
6. Present an opportunity for the owner to set forth his environmental protection plans to the public.

Hopefully, we can rely on the formal acceptance by environmentalists and regulatory agencies, and facilitate timely completion of fossil plants within schedule and budgetary constraints. This also means that we will have to begin project planning and public coordination earlier so that the documentation and review processes won't delay meeting of pressing power needs.

All fossil fueled power plants have some impact on the environment. It is the responsibility of the utility to see that the most advantageous site has been selected and that the design of the facility utilizes the best practicable technology, so that the public interest is well served. It is the responsibility of the public to evaluate costs and effects promptly so reasonable conclusions are reached and schedules can be maintained.

Copies of Mr. Goldman's speech were not available at time of printing. For further information concerning the speech we suggest you contact:

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THE CORPS OF ENGINEERS AND THE ENVIRONMENTAL IMPACT STATEMENT

By

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I. Introduction

Along with the majority of Americans, the Corps of Engineers is aware that there is a limit to the burden our natural environment can bear, that we must conserve our natural resources, and that use of our natural resources requires careful and wise planning.

Actions by the Corps of Engineers are carried out with the realization that man's environment is composed of interdependent systems -- both natural and manmade. Perhaps more than most, the Corps is aware that growing demands for resource consumption pose serious threats to maintenance of a quality environment.

The Corps more often than not faces an apparent dilemma. On the one hand, there are pressures and demands to develop water resources to support and maintain a high standard of living for increasing numbers of American people. On the other hand, the Corps is called upon to conserve resources to preserve the quality of the natural environment. The Corps has responded to the problem. I would like to quote the words of Lieutenant General F. J. Clarke, Chief of Engineers, Washington, D.C.:

> "The Corps will continue to seek balance in meeting the environmental and developmental needs of our Nation. Merely determining whether or not a specific engineering solution is economically justified is not enough. We shall encourage and support efforts to bring the best existing ecological knowledge and insights to bear on planning, developing, and managing the Nation's water and related land resources. Environmental values will receive full consideration along with economic, social, and technical factors."

II. Actions

In developing a program of environmental protection and enhancement, the Corps of Engineers has instituted a wide array of actions. Included are:

1. Developed guidelines and regulations directing that all Corps actions are made in full compliance with the spirit, intent, and letter of the National Environmental Policy Act of 1969.

2. Formed the Chief of Engineers Environmental Advisory Board. The Board is composed of six outstanding authorities on environmental matters. The Board is asked to:

a. Examine existing and proposed policies and programs to pinpoint problems and make suggestions;

b. Advise on how the Corps can improve working relations with the public and conservation community;

c. Advise on environmental problems or issues pertinent to specific plans or programs; and

d. View their responsibilities within the context of the present and future, rather than dwelling on past problems.

Current Board members are: Roland C. Clement, Chairman, Vice President, National Audubon Society; Dr. Lois Sharpe, League of Women Voters; Dr. Richard Backurs, Woods Hole Oceanographic Institution; Dr. Lynton K. Cladwell, Professor of Political Science, Indiana University; Mr. Harold Gilliam, Environmental Reporter, San Francisco Chronicle; Mr. Richard H. Pough, Chairman of the Board, Open Space Action Institute and Chairman of the Board, America the Beautiful Fund.

3. The Corps also implemented the policy of public participation as an integral part of the planning and administrative process.

4. Intensified coordination efforts of project formulation with conservation-oriented organizations and individuals, as well as Federal, State, and local governmental agencies.

5. Added to its staff, at all levels, personnel with background, experience, and expertise in the diverse disciplines necessary for fundamental planning and administration of water resource projects. This process of staffing is continuing.

III. Handling of Environmental Impact Statements

With the foregoing as background, I will now get to the specific actions of the Corps regarding environmental statements. Basic guidelines and procedures are contained in Engineer Regulation 1105-2-507, dated 3 January 1972 entitled "Planning, Preparation, and Coordination of Environmental Statements." It should be pointed out this regulation is for civil works projects as opposed to military actions and programs.

ER 1105-2-507 is based on:

1. The National Environmental Policy Act of 1969.

2. Executive Order No. 11514, "Protection and Enhancement of Environmental Quality," dated 5 March 1970.

3. Guidelines of the Council on Environmental Quality.

4. Section 309 of the Clean Air Amendments of 1970.

5. Freedom of Information Act, and

6. Section 122 of the River and Harbor Act of 1970.

The regulation specifies actions requiring preparation of an environmental statement. These may be categorized as follows:

1. Recommendations or reports to Congress on proposals for legislation.

2. Recommendations or reports for authorization of projects by the Chief of Engineers or Secretary of the Army under special continuing authorities. These authorities include: small flood control projects; small navigation projects, snagging and clearing projects; and other small projects.

3. Projects involving construction and land acquisition.

4. Operation and maintenance of Corps projects.

5. Issuance of regulatory permits.

There are several actions which are excluded from required preparation of a statement. These are: emergency protection and disaster recovery actions performed by the Corps of Engineers under authority of Public Law 99-84; emergency bank protection for highways and highway bridge approaches, and public works; emergency snagging and clearing (except where disposal of sediments and dredged material is involved); and actions directed by the Office of Emergency Preparedness.

The Corps views the environmental statement as a summary of all direct and indirect impacts of a proposed action. Admittedly, judgments enter into many of the considerations; however, to the greatest extent possible, published or otherwise documented data are used to support appraisals of impacts. Information from other Federal agencies, State and local agencies, conservation organizations, and individuals is actively sought and used. Objective treatment of all assessments is carried out. The adverse environmental effects as well as the favorable effects of each considered alternative are evaluated, and steps are taken to avoid overstatements, either favorable or unfavorable.

After the coordination of project plans and environmental matters with all known interested agencies, groups, and individuals has been completed, a draft of the environmental statement is prepared. Drafts of environmental statements are of two types. In the nomenclature of the Crops of Engineers, a preliminary draft statement is prepared for proposals being processed for possible authorization. The review period for preliminary draft statements may be as short as 30 days except that 45 days is allowed for comment by the Environmental Protection Agency. After the review period, the preliminary draft statement is converted to the draft statement which then accompanies the survey report in its review process. For authorized projects for which an environmental statement is being prepared, the review statement circulated for comment is called initially simply a draft environmental statement. The time allowed for receipt of views is usually 45 days -- in exceptional cases, this may be cut to 30 days.

Review drafts are sent to all known entities -- Federal, State, and local organizations, and individuals. Copies of the draft are filed with the Council on Environmental Quality. The general public is informed through news releases, and drafts are made available to the public upon request.

I might mention here that time limits also are established for when an action may proceed. This time limit is based on the date the draft environmental statement is made available for review to outside agencies and furnished to the Council on Environmental Quality. No administrative action may be taken sooner than 90 days after the draft statement has been filed with the Council on Environmental Quality.

After receipt of comments regarding the draft statement, a final statement is prepared. The final statement contains copies of all letters of comment, an analysis of and response to comments received, and revised wording of the statement as warranted. The final statement is reviewed at both District and Division levels and forwarded to the Office of the Chief of Engineers. From the Chief of Engineers, the final statement is processed through the Office of the Secretary of the Army for filing with the Council on Environmental Quality. At that point, another time limitation regarding administrative action is provided. No action may proceed sooner than 30 days after the final statement has been filed with the Council on Environmental Quality.

After filing of the final environmental statement, a news release is issued informing the general public that the final statement has reached the Council. At this point, copies of the final statement are transmitted to the agencies, organizations, and individuals who commented on the draft statement. Also, at this point, any additional comments may be provided to the Council on Environmental Quality within the 30-day period.

Corps of Engineers regulations also cover the subject of timeliness of statements. To assure that environmental considerations are kept up to date, the regulations provide that for new proposals, agency comments and views expressed shall not be older than 12 months, and for previously authorized projects, not older than 3 years. Also provision is made for revision of statements if significant changes of fact have occurred since a statement was filed.

IV. Impact Assessment

At the inception of any environmental assessment, one is immediately aware of inherent shortcomings of basic knowledge. Even with the use of representatives from many disciplines, it is painfully evident that a pressing need exists for practical analytical systems to evaluate and predict environmental consequences of a particular activity. Much more basic research needs to be done to fill some of the wide gaps in our knowledge. Ecologists, it seems, are too often embarrassed by the "knowledge gap."

A case in point is a requirement in NEPA Section 102 (2) B which contains the following:

> "All agencies of the Federal Government shall identify and develop methods and procedures, in consultation with the Council on Environmental Quality which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations."

Implied in this language is the admonition for agencies to develop a means to quantify all of those present intangibles which generally are associated with a healthful, pleasing, and useful environment. In short, it means we need the quantities expressed in terms applicable to a balance sheet of pluses and minuses. I am aware of some attempts to do just this, but the state of the art is only now in its infancy.

Lacking answers in detail, and in some areas even a general sense, we rely on the facts known now and do the best we can with the tools at hand. As noted earlier, the Corps employs representatives from many disciplines to carry out environmental investigations. Wildlife biologists, fishery biologists, general ecologists, foresters, geologists, geographers, urban planners -- even anthropologists, sociologists, and oceanographers --

to name some of them. The Corps also relies on expertise in other Federal agencies, State agencies, and universities. The hiring of consultant firms or individual consultants in the environmental field has become a routine matter.

The "guts" of any environmental statement are contained in two sections. The analysis of impacts of a proposed action is one. The other is consideration of alternative courses of action. In some respects, the treatment of alternatives is the most difficult area. Basically, we seek the most imaginative list of alternatives to display a realistic array of alternatives to the decision-makers. But immediately, questions arise. How deeply should we delve into developing a list of alternative courses? How much detail is required in the formulation of viable alternative plans? What criteria should be applied to alternatives which would allow keeping options open for future considerations? Again, practical judgment plays a major role in developing the alternative section of the environmental statement.

V. The Decision Process

The Corps of Engineers views the environmental statement as the basic document summarizing impacts of the proposed actions, display of possible alternatives, analyses of unavoidable adverse effects, and the summary of coordination carried out with all appropriate agencies, groups, and individuals. However, it is not the decision document. Using all available information, including the environmental statement, the District Engineer must decide on a recommended course of action. Although based in large part on the environmental statement, other sources of information are relied upon including records of public meetings, project documents, stated views of governmental agencies and officials, private organizations, and Congressionally specified purposes. Information developed in response to the expressed needs of Congress as contained in Section 122 of the Flood Control Act of 1970 (P.L. 91-611) is a major source relied upon. Section 122 directs that full consideration shall be given in any proposed project to the possible adverse economic, social, and environmental effects. The rationale for the decision is brought together in the Statement of Findings. The Statement of Findings is prepared after comments have been received from outside entities regarding the draft environmental statement. The Statement of Findings addresses all known facets of a proposed action including, but not necessarily limited to, effects of the action on area economics, social well-being, environmental matters, and engineering feasibility. The Statement of Findings accompanies the District Engineer's report on the proposal, or in the case of a previously submitted report, the Statement of Findings accompanies the final environmental statement.

VI. Summary

In summary, the Corps of Engineers is dedicated to the proposition that environmental concerns in proposed or operational water resource projects will receive equal and balanced treatment along with economic and engineering factors. The Corps seeks and welcomes active public participation in the planning process. In carrying out its responsibilities, diligent care is taken to insure that the objectives of the National Environmental Policy Act are met, and that projects are based on the best existing ecological insight. Preparation and filing of the Environmental Statement is a major part in the decision-making process and, in the long-run assures that environmental quality receives the fullest consideration it deserves. Preparation of the Environmental Statement is a costly item - both in money terms and in time. Frequently, the cost of projects is significantly increased by measures formulated to assure a better project. Frequently, too, projects are delayed in time for the same purpose. In the long run, however, the final product is a much better one not only for our generation but for future generations as well.

THE BUREAU OF RECLAMATION AND THE ENVIRONMENTAL IMPACT STATEMENT

By

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When the National Environmental Policy Act (NEPA) became law on January 1, 1970, the Bureau, like most other Federal agencies, was operating under the multipurpose concept. Prior to 1970 we had been directed by both law and policy to give consideration to the environment in our programs, but certainly not to the extent required by NEPA. The intent of NEPA was to make environmental concerns of primary importance in all Federal activities. I can assure you that it has had a tremendous impact on all phases of the Bureau's activities.

Background

One problem that arises immediately with new legislation with far reaching effects such as NEPA is that immediate compliance is required, yet a shakedown period is necessary to determine what is required and how it integrates with the ongoing program. NEPA became effective on January 1, 1970, but it was April 1971, over 15 months later, before the Council on Environmental Quality (CEQ) published the guidelines needed for Federal agencies to effectively implement this law. Then our own Department of Interior published policy guidelines some 5 months later in September 1971, and finally the Bureau of Reclamation published instructions for preparation, review, and processing of environmental impact statements and distributed them to operating field offices in December 1971. Therefore, it was nearly 2 years after the enactment of NEPA that useful instructions were available to the field.

As you can well imagine, there was a lot of confusion and lost motion in these early months as we struggled to cope with the requirements of NEPA. These were difficult times for all of us who were involved in the water resource development field, but they were also times of review and reassessment of policies and programs; but most importantly, it was a time of learning and readjustment. There have been many problems and conflicts but a lot of good results have been produced. It has now been almost 3 years since NEPA became law, and while we certainly don't claim to have answers to all the issues raised by NEPA, to quote a popular commercial, "We've come a long way, baby." As of today, the Bureau has prepared and processed nearly 70 environmental statements. About half of the statements on file with CEQ are draft statements; the other half are final statements.

If you are unimpressed by this number, I would remind you that each of these statements goes through a process that requires three draft stages, and each draft goes through at least three levels of review before going to CEQ as a final environmental statement. That word, "statement," is misleading - it doesn't accurately describe the document that becomes the final environmental statement. For example, the final environmental statement for the Central Arizona Project is a rather impressive volume of some 420 pages. Not all of them are so large, but the tendency certainly has been in that direction. I can distinctly remember those early days in the '70's when we assumed that a statement should be a couple of dozen pages of text.

In addition to our own statements, we also review statements from various other Federal agencies. This provides a good opportunity to see what others are doing and compare our statements with theirs.

The courts have played a very significant role in the short history of NEPA, and one test of compliance is to consider the number of court actions which have resulted from our environmental statements. To date, the Bureau is involved in only two such court actions: one is on the Lower Teton Project in eastern Idaho, which is in the construction stage; and the second is on the Glen Canyon Project, which involves reservoir encroachment on a natural bridge. We also feel, with some degree of certainty, that we will be involved in two or three other court actions in the near future. This is perhaps a negative approach; a better test would be to consider the comments made on our statements during the review process and our ability to respond. We haven't been able to satisfy all the reviewers in responding to their comments, and in fact, probably never will; but our more recent statements indicate much improvement in considering the concerns of the environmental community.

Problems Encountered

With this background on where we've been in the environmental statement business during the past 3 years, I'd like to turn now more specifically to some of the problems we have encountered during this period. When NEPA became law in January 1970, we had projects in all stages of planning, construction, and operation, and all of them had environmental impacts to varying degrees. One of our first major problems was determining what constitutes a "major Federal action" and therefore required an environmental statement. I feel that perhaps we overreacted and tried to prepare statements for virtually everything, and in doing so, severely hurt our total effort by spreading our capability too thin. In this respect, since the Reclamation Instructions were published the preparation and processing of statements has flowed more smoothly. So far, our instructions have stood the test of time well and we feel they have aided us in being responsive to the requirements of NEPA. They focus attention on the critical areas by forcing us to determine environmental impacts associated with our program. They also set up a well-defined procedure for preparation and processing statements, which follows the letter and spirit of NEPA. I have several copies of these instructions if any of you are interested in seeing them.

Planning Phase - In our planning activities, the problems of implementing NEPA depended on the stage of the study. Some studies were terminated when it became evident that the environmental impacts were of such significance that the project wasn't acceptable. Others, in the very early stages of planning, had the flexibility to accommodate the new requirements. The only problem here was lack of criteria, data, and methodology. For those in the latter stages of planning, but not authorized, the problems were more difficult.

This points up another major problem area: defining and measuring environmental impacts. We have considerable expertise in the area of quantifying economic effects. Environmental effects are much more elusive and we found that we had neither the expertise nor the methodology to assess these effects. NEPA calls for a discussion of alternatives in adequate detail to disclose the benefits and opportunities that will be foregone should the project be constructed. Without some means of quantifying environmental and social effects, this task becomes impossible, and we floundered badly in this area. I'll discuss our efforts in this area of evaluating environmental impacts later.

Another major problem encountered as we incorporated the requirements of NEPA into our planning studies was the problem of "who pays and how." The costs of maintaining and enhancing our environment will not be small. The mandate of NEPA to restore and maintain environmental quality is clear, but the means to finance these measures is a subject of much conjecture and controversy, and I suspect this will continue for some time. Obviously, it will be difficult to plan realistically when such basic issues remain unresolved. We are now in the process of changing our planning procedures to accommodate the NEPA requirements; and while this will help, it will also make the planning process much more complicated.

Construction Phase - The problems encountered by projects that are authorized or in construction are much more difficult to resolve than those in the planning stage. Each of our projects is reviewed by Congress and specific authorizing legislation is written which imposes critical constraints on both funds and the plan of development. Generally, we are also involved in contracts to provide water, power, or other services which impose additional constraints on the project. With all these constraints imposed, it is virtually impossible to meet all the requirements of NEPA. For example, how can alternatives be realistically discussed when the size, scope, and functions of the project have been set by the authorizing legislation? This particular question has led to much of the bitter controversy between Federal agencies and the conservation groups. For the most part, the projects have been modified to reduce environmental impacts but this is not a completely satisfactory solution. I anticipate that this type of problem will be much less critical when we are dealing with projects that have been planned and authorized under the criteria set by NEPA. Incidentally, I don't want to create the impression that there are major environmental conflicts in all of our projects. On the contrary, in most of our projects now under construction we have been able to prepare acceptabel environmental statements and they are underway without major conflicts. However, those with high conflict potential certainly continue to get their share of publicity.

Operating Phase - The effects of NEPA have probably been least felt in our operating projects. The storage facilities for many of these have been constructed in highly sensitive environmental settings and their operation has been greatly influenced by environmental impacts long before NEPA came into being. However, there is a great potential for improving the operation of these existing projects from an environmental viewpoint, and I am confident that we will explore this area further in the future. Environmental statements have been prepared for construction required to update and rehabilitate existing works. Since this activity takes place on operating projects with well established environmental settings, there has been little controversy. Environmental statements may also be required if a significant change is made in the operating plan.

Looking Ahead

Having belabored the Bureau's problems at length, I would now like to turn to perhaps the more positive aspects and describe some of the things we are doing to incorporate the concepts of NEPA into our program.

The Water Resources Council has developed and published in the Federal Register a set of proposed principles and standards for planning water and related land resources. These proposed principles, commonly referred to as "Multiobjective Planning," set forth a very complicated planning process and I do not want to get into the details here. What is relevant to our discussions here is the requirement that alternatives be prepared that emphasize national economic objectives, regional objectives, and environmental objectives. These planning procedures were developed to insure that the environment is fully considered in our planning studies, and they are certainly responsive to the requirements of NEPA. Over the past year we have been developing guidelines for implementation of multiobjective planning. These guidelines will be available for review about the first of the year and we expect to have the system fully integrated into our planning process by 1974.

Earlier I mentioned our need to better evaluate environmental impacts, particularly in our planning studies. For some time now we have been actively involved in developing environmental evaluation systems. The purpose of an environmental evaluation system is to measure environmental impacts of proposed actions so alternatives can be developed and compared. To date we have developed two systems. These are interesting because, while their purposes are quite similar, the approach and methodology is totally different.

One of these systems has been developed in-house as a part of the multiobjective planning guidelines which I mentioned earlier. Other Federal and state agencies worked closely with us and made significant contributions. In this system, the component parts of the environment are described under 20 categories (Figure 1). The categories are rated, using evaluation factors which include:

a. Quality
b. Quantity
c. Human Influence
d. Uniqueness
e. Magnitude
f. Significance

By applying these evaluation factors to the 20 categories, a numerical rating is obtained. These ratings are used to compare present environmental conditions, future conditions without the project, and future conditions with the project. The system is frankly subjective because it assumes that most environmental effects vary depending on the perceptions of the individual concerned. The environmental categories are evaluated separately; the numerical rating obtained cannot be added together into a useful numerical total. This system has been tested on seven Bureau planning studies, using the multidisciplinary team approach.

The second system was developed for the Bureau by Battelle-Columbus under a research contract. It is a highly structured hierarchical system containing four major categories, 18 components, and 78 parameters.

CLASS	CATEGORY
AREAS OF NATURAL BEAUTY AND HUMAN ENJOYMENT	OPEN SPACE AND GREENBELTS STREAMS AND STREAM SYSTEMS LAKES AND RESERVOIRS BEACHES AND SHORES WILDERNESS, PRIMITIVE, AND NATURAL AREAS ESTUARINE AND WETLAND AREAS OTHER AREAS OF NATURAL BEAUTY
ARCHAEOLOGICAL, HISTORICAL AND CULTURAL ELEMENTS	ARCHAEOLOGICAL RESOURCES HISTORICAL RESOURCES CULTURAL RESOURCES
BIOLOGICAL, GEOLOGICAL AND ECOLOGICAL ELEMENTS	BIOLOGICAL RESOURCES FLORA FAUNA GEOLOGICAL RESOURCES ECOLOGICAL SYSTEMS
QUALITY CONSIDERATIONS	WATER QUALITY AIR QUALITY LAND QUALITY SOUND QUALITY VISUAL QUALITY
UNIQUENESS AND IRREVERSIBILITY CONSIDERATIONS	UNIQUENESS CONSIDERATIONS IRREVERSIBILITY CONSIDERATIONS

Figure 1
Environmental Evaluation System
Guidelines for Multiobjective Planning

(Figure 2) Each parameter is assigned an importance factor which remains the same for all evaluations. Methods of measuring the environmental parameters are developed which result in commensurate units. This measurement of the parameter is multiplied by its importance factor to obtain the environmental impact. Differences between alternative plans are indicated by comparing the environmental impacts computed for each. Since units are commensurate, the values developed can be totaled for comparison and tradeoffs can be studied. The system has been tested on only one Bureau project by Battelle but we plan to test it on other projects soon. The major weakness of the system rests with our compability to measure many of the parameters with a good degree of confidence. We have a task force studying these systems as well as others to recommend the system which should be used in our planning procedures.

I previously indicated that we did not have the expertise in environmental fields to properly respond to the needs of NEPA. Since January 1970, we have been hiring environmental specialists, and today nearly all of our offices have at least one specialist. We also need to train our technical people to better understand and work with environmental matters, but there are few places to obtain such training. With all this, it is obvious that we still will not have personnel competent to cover all fields in environmental studies. For this reason, we have contracted with private consultants to make environmental assessments of highly controversial projects. We have not advanced far enough with these efforts to accurately evaluate them. We have also found the universities to be very capable in preparing biological inventories for specific areas.

One last thing I might mention is the development of a public involvement program. Through this type of program we feel we can bring environmental concerns into our program at an early stage so they can be included from planning through operation. This early input should make our reports and projects more responsive to NEPA.

Conclusion

NEPA states in part, ".....it is to be the continuing policy of the Federal Government ......to use all practical means and measures..... to create and maintain conditions under which man and nature can exist in productive harmony...." Looking back over the past 3 years, this goal is being achieved. Certainly NEPA has had a tremendous effect on the Bureau's entire operation, due in a large measure to the requirement for environmental impact statements. NEPA points out the road to a better environment and the environmental impact statement is the sharp stick that keeps us on the road.

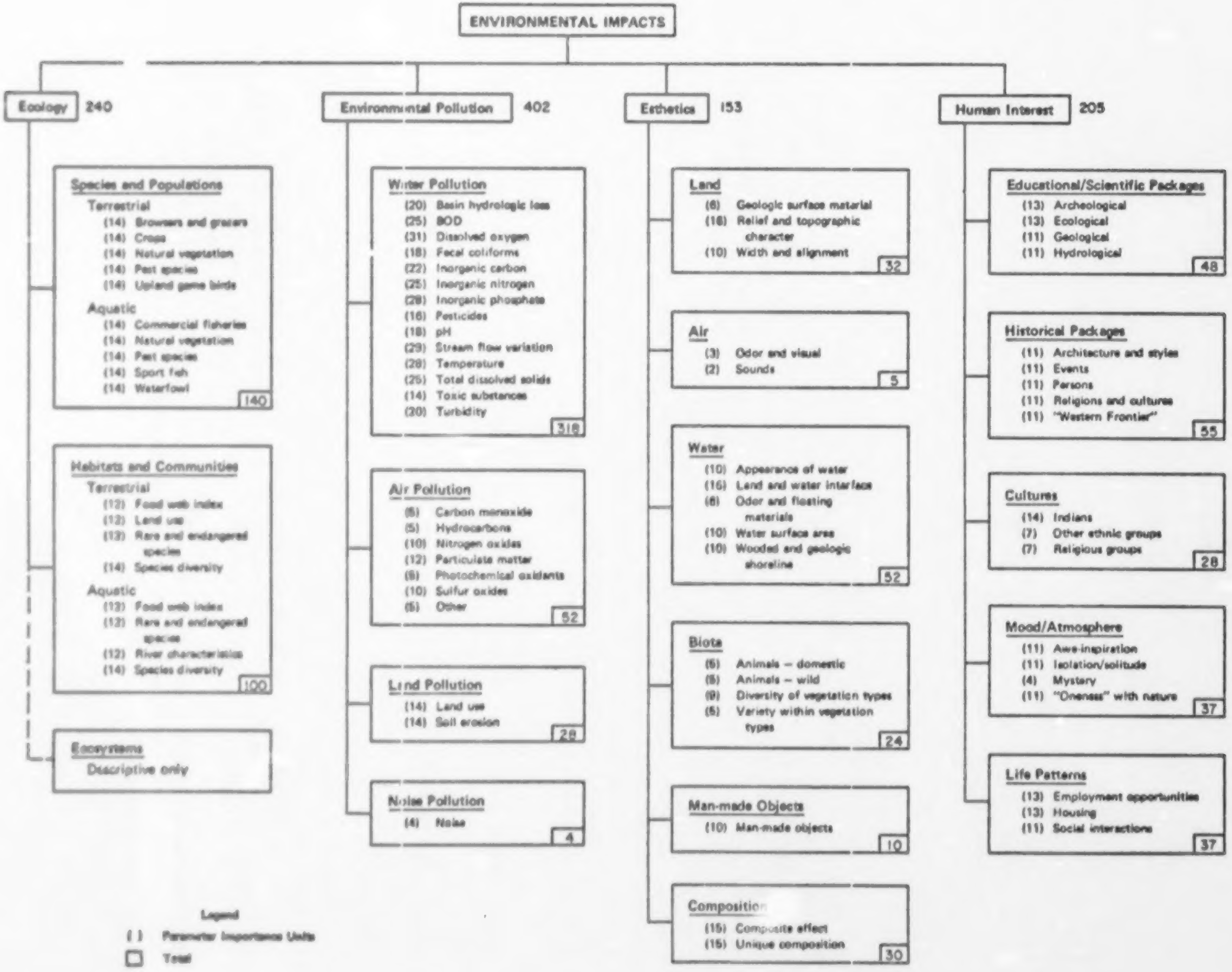
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Figure 2

Battelle Environmental Evaluation System

WATER RESOURCE DEVELOPMENT AND THE ENVIRONMENTAL IMPACT STATEMENT WITHIN THE SOIL CONSERVATION SERVICE

By

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The National Environmental Policy Act of 1969 (NEPA) is helping the Soil Conservation Service (SCS) weld its several conservation disciplines into a better single working unit. To produce total resource conservation plans, SCS employs many disciplines. They include agronomists, biologists, foresters, soil scientists, and various engineering disciplines. The combined talents of the disciplines named, plus all others within SCS, have long been used, in combination, to assist local entities solve soil, water and related conservation problems. Under NEPA, these same talents are combined to produce environmental impact statements as adjuncts to project work plans. But our years of experience have highlighted deficiencies in the interdisciplinary planning process. It is these points that the National Environmental Policy Act is helping us to locate, identify, and correct. These same deficiencies have been partially responsible for causing confusion and the spread of misinformation about environmental impact statements. Note that I said that they have only been partially responsible. There are other bugs associated with this new phase of an old program. Let me discuss them all together.

Causes of Confusion and Misinformation About Environmental Impact Statements

The Soil Conservation Service administers the Small Watersheds Program (PL-566). It is this program around which considerable misinformation about environmental impact statements has developed. After NEPA became law (January 1, 1970), it was clear that the development of a watershed project partially financed with federal funds was a "major federal action" as defined in the Act. So all new projects planned would require an environmental statement. This was clear.

Watershed projects planned or under construction before January 1, 1970 were another matter. Did they also require statements? The preparation of statements is costly in both time and money. Job reassignments are sometimes necessary as are fund adjustments to fulfill new obligations. An agency gearing up to handle a new phase of an old program proceeds with caution and works out the problems as it goes along. The cautious approach, while practical from the agency's viewpoint, was subject to criticism by those who felt an immediate and full response to the Act was the only avenue. Lacking immediate response, suspicions as to the intent of the agency in complying with the law arose and promoted the spread of misinformation.

How can such situations be avoided? I doubt that they can. Even if the concerned program had unencumbered funds and surplus personnel to meet such contingencies, unavoidable delays would still develop. The agency must test each step to determine its fitness with the interpretation of the law.

Deficiencies in the interdisciplinary planning process mentioned earlier in this paper are another problem. Criticism was aimed at the engineers for dominating watershed planning to the exclusion of other disciplines - disciplines that should play equal roles in resource development. Environmental impact statements, it was charged, lacked depth in that the natural sciences were not treated in the same detail as the engineering phases. This criticism, we feel is valid. It was recognized long before NEPA and efforts were made and are continuing to be made to correct the situation. NEPA is providing helpful support.

The engineers should not be condemned for dominating the program. An equally valid condemnation might be laid at the door of other disciplines for lack of aggressiveness, for not conducting investigations in the depth comparable to that of the engineers, for not insisting that some resource problems be solved by means other than engineering practices where such was possible. But I think it is best not to condemn any discipline. Rather, we should recognize the situation for what it really is - an evolving, developing program requiring checks and balances. As of this time, we see the scales tipped on the side of the engineering practice. Our job is to work for equilibrium. We must coordinate work schedules to produce project work plans that reflect complete integration of all disciplines. When work plans are properly developed, environmental impact statements will be also. The present imbalance is explainable. Each practitioner has a way of becoming completely immersed in his speciality. It is easy to neglect that part of his job which is to blend his speciality with all others as a part of the planning process. And it is easy for a specialist to supply a quick solution to a new problem and neglect his colleagues, especially if a high demand exists for that answer. Heavy demands build fast in certain aspects of the conservation field, and the specialist with the first fast remedy and pat answer is likely to get the assignment to supply assistance. Programs built around a single speciality develop in this way. This is not a good thing and eventually adjustments must be made to include the broad spectrum of talents.

The Soil Conservation Service, like other conservation agencies, has struggled against fast remedies and pat answers that ignore the long term effects on natural resources. The National Environmental Policy Act has given us the opportunity to take another look at our program in keeping with the new emphasis embodied in the Act.

The fish and wildlife field, generated considerable confusion and misinformation concerning environmental impact statements. And much of it was due to the lack of an adequate inventory of the quantity and quality of existing habitats plus the kinds and amounts of animals they support. Too often, data collected in one watershed are used to support or to criticize the proposed work in another watershed. While there may be a relationship, it is often overemphasized; or no valid relationship actually exists. Data of this nature is best collected on the watershed proposed for development. Such information is vital to the preparation of an adequate work plan and to an adequate environmental statement. Without it, the planning agency is at the mercy of the vague accusation. And vague accusations quickly degenerate into confusion and misinformation. Here again, the problem has been one of adjusting to a new requirement as a part of a going program. Funds and personnel are being aligned to satisfy the need for better inventory information.

The amount of detail to be included in the environmental statement is a problem not completely settled, at least to everyone's satisfaction. We are aware that the statement must be complete to the point of clear understanding by readers. But we are equally aware that it should not be voluminous. The question asked by writers is "how much is too much, and how little is not enough?" We are relying on our own experience and the comments of reviewers to help us in this area.

The use of subjective words and phrases in environmental impact statements is another cause of confusion and misinformation. Words such as "significant," "almost," "some," "about," and "important" have a way of creeping into the manuscript. Their meaning grows less clear the farther the reviewer is from the writer. For most of us, it is difficult to write hard, flat, undecorated narrative. Such writing is boring to the average reader, but hard facts and figures are essential to a well written environmental impact statement. They have no substitute. I know of no reviewers or other readers who are reading impact statements for pleasure, so the more concise the wording the better. We reduce confusion and the cost of writing and rewriting statements when we use facts and figures only.

Alternative plans considered in the planning process and described in the environmental statement have produced controversy. Alternatives, it was charged, were not discussed in sufficient detail to convince the reviewer that the alternatives explored were, in fact, explored in depth. Environmental statements short on explanation make the selected plan suspect. Too often, it seems the writer falls into the trap of thinking everyone should be able to understand the selection as clearly as he himself does. To the writer, the obvious should be obvious to everyone.

The lack of research based answers is the last point I would discuss in this area of causes of confusion and misinformation. In the wildlife field for example, there is a need to know the response of various animals to the loss, gain, or rearrangement of habitat elements. A better picture of before and after project development is needed in order to clearly describe project impact. Studies on streams and fish populations are quite complete, at least for the present, but an improved knowledge of the response of terrestrial and semi-aquatic wildlife is only partially complete. A number of before-project studies have been done. The last half of the studies await project installation. Answers needed now are some years in the future.

These, then, are some of the causes of confusion and misinformation about environmental impact statements as experienced by the Soil Conservation Service. There are bottlenecks connected with resolving present problems, but we see none that are insurmountable. We, in SCS, are far from satisfied with the impact statements as developed in the past. We insist that those coming off the presses will be much improved.

How the Environmental Impact Statement Influences Engineering Practice

The environmental impact statement has indeed influenced the engineering practice within the Soil Conservation Service. NEPA brought into sharp focus the need to alter the usual design in order to avoid or mitigate damage to the environment. It forced design changes on a broad scale - changes that for one reason or another could not be made or were not made prior to the Act. Examples are channel work that is now done from one side only, leaving the opposite bank and its vegetation largely undisturbed; tubes through dams and fish ladders that permit free movement of stream fish; bottom water overflow devices in dams to enhance or preserve water quality and fish habitat downstream; channels designed and installed to accommodate flood flows only, and designs modified to reduce the level of flood protection. There are numerous others, including no design at all. This occurs when environmental considerations outweigh any benefits that might be derived from the possible installation of an engineering practice. This latter approach, I may point out, has long been employed in other Service programs. For example, resource conservation planning assistance to farmers and ranchers has included preserving wetlands, woodlands, and wildlife cover instead of employing engineering practices to change the land use. Landowners may not relate the presence of a covey of quail to a clump of brush or a brood of ducks to a wetland until it is pointed out during the process of land use planning. Faced with the alternatives, many choose in favor of the more natural environment. Also, there is a growing awareness on the part of landowners that erosion, sedimentation, and minor flood problems can be controlled with measures other than those which modify the landscape. Improved conservation cropping systems, crop residue management, and better management of woodlands and grasslands are, on some soils, effective alternatives to engineering practices.

The environmental impact statement influences engineering design by highlighting those measures required to mitigate unavoidable damages. Designs are needed to construct wetlands to replace those damaged by project development; to build pools, bank cover, and greater depth of flow in fish streams; removal of reservoir waters at varying depths to create or maintain fish waters in channels or to improve the quality of flowing waters. In addition, pressures are increasing to design structures that blend with the natural environment. "Sore thumbs," despite their engineering quality, are becoming less aceptable.

How the Environmental Impact Statement Influences Other Disciplines

Disciplines other than engineering are also influenced by the need to prepare an environmental impact statement. Most involve the inventory and status of resources as they exist on the planning area. They involve the projected needs for maintaining or improving resources such as soils, water, plants and animals. Considerable more information is needed in environmental statements on the response of soils to more intensive cropping; to various kinds of cropping systems; and the kinds of erosion control measures required under anticipated changes in land use. In the biology field, better inventories of habitat types and of species and their populations both existing and anticipated are now in short supply. Thorough inventories are necessary to the identification and location of rare and endangered plants and animals. Other species that add to the quality of life must be more fully considered for enhancement and protection.

Inventories are logically done by the separate disciplines, but their review is best accomplished through the interdisciplinary process. Improvement, we feel, is needed in this area. Each discipline must have the opportunity to defend and thereafter refine his recommendations based on inventory. This opportunity is best accomplished through an interdisciplinary team review. As a further contribution, each discipline should draft his appropriate section of the project work plan and the environmental impact statement. The drafts produced are best again reviewed by the interdisciplinary team. Integration of the disciplines is essential to a practical work plan and a sound environmental statement The reviewing team must determine that the data are complete and defendable; that the wording used is objective, clear, concise, and that the final draft truly reflects the interdisciplinary approach to sound environmental planning.

We in SCS want to produce environmental impact statements of the highest quality. We believe that we are making headway, but we are not satisfied with the product produced thus far. Meetings such as this help us to identify new approaches and refine our old ones.

A CONSULTANTS APPROACH TO ENVIRONMENTAL IMPACT STATEMENTS

By

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In order to evaluate what I say this morning a certain amount of philosophy has to be exchanged. First, I believe the National Environmental Protection Act of 1969 provided the legislature impetus needed to move us into an area of evaluation of the impact of man's environment on the natural environment that was greatly needed.

As a consultant, I feel NEPA provided a golden opportunity for us to become more comprehensive in our studies and investigations. The requirements outlined in NEPA represent good professional practice that we should have followed for some time. NEPA has forced us to adopt a more comprehensive posture in our work.

My main concern in regard to NEPA and related environmental impact statements centers on four points. The first point is that generally not enough time is given to the structuring of an environmental impact statement. When drafting an environmental impact statement one is at the mercy of the studies that initiated the projects. If these studies have had the correct philosophical direction the draft statement becomes rather straight forward. Unfortunately, this is not often the case and a great deal of time can be spent in drafting an environmental impact statement on tasks that should have been performed in the initial studies.

I hold three other points of concern that center on the philosophical intent of the NEPA and environmental studies in general. To outline, environmental impact statements and environmental studies generally suffer from an extensive amount of negativism, second and third generation impacts are seldom explored, and finally social impact is often seriously neglected. I will attempt to discuss to a limited degree these three areas of concern.

In order to do so it is necessary to define the terms environment and impact. But defining environment is a difficult endeavor without reward. Webster had the same difficulty defining environment as: "the act of environing or the state of being environed." For engineers at least who are use to precise definitions this definition of environment is liable to produce cardiac arrest.

The point is all disciplines have developed their own definitions. The sociologist and ecologist for instance will have different views of the definition of the term. The only certainty is that it is difficult to isolate any thing or factor that has not been considered an important part of the environment at some time.

In view of Webster's difficulty and in view of a huge number of things that could be included in the environment, the definition must be by necessity very general. An acceptable definition of environment is: the summation of surrounding things, conditions and influences.

Now that I have muddied the water concerning the definition of environment, let me attempt a definition of impact. Part of my training has been as a traffic engineer. This field has taught me that two cars colliding will cause considerable impact and result in considerable property damage. I believe this conotation of impact has carried over into the environmental area. The concept of many citizens and some professionals is that environmental impact is something bad that happens to wildlife. It may be that impact is not a good selection of terms. None-the-less, the term used remains impact. The position must be taken that impact can represent a benefit as well as a cost, that there are both positive and negative impacts.

To summarize, I feel that environmental impact implies: the benefits or costs of a proposed action on the summation of surrounding things, conditions and influences.

The vagueness of this implication is a measure of difficulty inherent in dealing with environmental studies. No one person has the mental capability of rectifying the knowledge necessary to conduct an environmental study. In most instances and for the same reason many consulting firms are not capable of completely developing an environmental study. Environmental studies demand a multi-disciplinary approach. Professionals from various compartments of knowledge are needed to insure the proper focus and knowledge imput into the study.

It is most fashionable these days to refer to oneself as an environmentalist. Once having assigned yourself this title, a professional from a wide spectrum of disciplines can easily move into the role of environmental consultant. A secretary of the Department of Housing and Urban Development stated in testimony before a House Subcommittee, "we are in danger of creating a bureaucracy of professional statement writers and readers as well as encouraging a parasitic consulting agency to thrive on the business of environmental statement preparation."

To some extent this danger has been realized. The vagueness of the definition of environment and short period of time that environmental questions have been before us have combined to leave those conducting environmental statements without needed analytic tools and people to engage in environmental studies that have no business in the field. We are in danger of treating the golden opportunity that NEPA represents in the manner of the Olympian who won a gold medal and in his joy stopped on his way home from the games to have it bronzed.

It use to be that an individual or a consulting firm that had developed many designs could point to the finished product or the completed end of this work as a statement of his ability to design. Environmentally the important thrust and a statement of the abilities of an individual or firm is how the project will be started and carried out. This represents a 180 degree turn-about from the historic position of consultants.

The role of a consultant in an environmental study is either as a contributor of knowledge or a generalist assimilating this knowledge. In any event the task is a great deal different than the historic task of the consultant. Historically the consultant has been asked to use his own abilities and create a design or conduct a study either task having a clear-cut result that is known before the project is started. With environmental studies, the consultant has little idea initially of possible problems or benefits resulting from the project he is studying. The result of different environmental studies is not the same. And the results of the study can only be evaluated if others can follow the approach taken and assimilate the data in the same way. A bridge design is not a complete failure unless it collapses although there may have been a large number of possible ways of designing the bridge. An environmental study is a failure however if others cannot or wouldn't approach and conduct the study in the same manner. For the end results of a bridge design offer many, many possibilities, but an environmental study should have only one end result.

This requires that the consultant in large measure abandon the staffing procedures, project programming and general philosophies of old. In the past, consultants have made reputations based on the abilities and specific knowledge of their staff to accomplish certain tasks extremely well. However, with environmental studies the most desirable abilities of the staff is not specialized knowledge, but generalized knowledge. For specific knowledge the consultant is best advised to rely on knowledge from professionals from other disciplines that are usually not associated with his firm but called together for specific projects.

Precisely the role of the consultant with regard to environmental studies is changing from the old pattern of procuring jobs to meet the staff abilities to one of procuring a staff to meet the job's demands.

There are also levels of environmental roles in which a consultant can become involved. A consultant can have projects that do not lead to an environmental impact statement, but will require a statement later. In this case, the consultant has a responsibility to conduct his project so that the basic requirements in writing impact statements are achieved.

To illustrate this premise, consider the project of locating a highway. If a consultant is given this project he will not be involved necessarily in writing the impact statement, but his report and the way he conducted his study will be important segments of the statement.

Consider four things relevant to locating a highway corridor:

1. need to study as many alternatives as possible
2. means of positing positive and negative impacts
3. need to have interdisciplinary team
4. means of communicating approach.

In a freeway corridor study in an around the City of Lincoln, Nebraska, a study approach and modeling technique was used that:

1. prejudged the effects or impacts of several hundred trillion alternatives
2. analyzed quantitatively the freeway's impact on ten different elements
3. provided an interdisciplinary input
4. used evaluation methods from other disciplines so that communication was gained.

In the jargon of systems engineering, the Lincoln Study was an open systems analysis. There are two general types of system analyses, the closed systems analysis and the open systems analysis. The closed systems analysis is considerably easier to structure because it assumes the item you're analyzing is without an environment, i.e., the item and its environment do not interact. No real world situation that I can think of is a closed system. Rather real world situations are open systems where items and their environment continuously interact. This is particularly true of a highway. A highway cannot be studied as a closed system. Because of its strong impact on the environemnt, it must be considered an open system.

In the Lincoln Study, the open systems analysis was constructed by using a slightly different structure of the analysis base for elements within the environment and elements that represented the system.

The study area of approximately 180 sq. miles was divided into zones of analysis that represented small parcels of land 900 feet square. These 7500 analysis zones served the purpose of addressing the data for the computer file.

A supply and demand structure was established for each of the ten elements studied.

Environmental Elements

1. Agriculture
2. Wildlife conservation
3. Replacement
4. Optimum physical features
5. Interference
6. Noise

System Elements

1. Cost
2. Aesthetics
3. Mode interface
4. Travel desires

This structure served as the analytical base. A preliminary evaluation of each element was conducted to posit the values of various categories of an element. The probability of existence and the probability of demand or desire of these categories was determined. These combined probabilities formed the statement of the "least social cost" location of the highway. Least social cost was defined as the resources that would have to be given up to obtain the facility in question.

This model is termed a Sto-netic model, a corruption of the words stochastic and cybernetics. Stochastic refers to the use of probabilities and cybernetics refers to self-governing systems. In this regard the Sto-netic modeling technique allows the data expressed as probabilities to govern the decision to be made, in this case the location of the highway corridor.

Having structured the probability of the "least social cost" location of the highway at each of 7500 analysis zones for each of the ten elements evaluated, the composite statement of "least social cost" was determined. The result was that one probability for each zone was developed that indicated the combined impact on all ten elements if the highway were to be located in that zone. By this method alternative highway corridors were located.

This same data in the probability format was used to evaluate the corridors. Known from the data was the combined impact of the highway on all ten elements and the impact on each element individually.

Whether this approach has been useful or not in writing the impact statement is still open to question. However, one corridor that was chosen crossed a park. It takes high level approval in order to cross 4-F land and one has to analyze all feasible alternatives. This approach has at least aided in this regard.

Again, two important points can be made. First, this approach is good professional practice even if it turns out not to be of particular value from the standpoint of the impact statement. And secondly, a good professional approach to a project can help ease the difficulty of writing the environmental impact statement.

A consultant can also participate directly in writing the statement. Here, the consultant is asked to put together all the elements and uncover the impact both negative and positive resulting from a project.

This can be a job of varying difficulty depending on the work done in the formative stages of the project. The most difficult task is that of determining second and third generation impacts. Time restraints usually effectively deter extensive investigation into these areas and many could not be uncovered even with a detailed investigation.

Much of the work done on impact statements tend to be subjective. Efforts of course are made to be objective and quantify data. These efforts are usually restricted however to the quantification analysis of elements within the environment and not quantification of the composite impact.

One study, a research project in Nebraska conducted by Dr. Michael Cowan, attempted to quantify the ecological impact of a proposed lake. A great deal of controversy surrounded the proposed construction of this lake and most of it centered on the ecological damage that would result. Most ecologists in the area held the view that the lake would cause damage. In fact Dr. Cowan felt this way. The result of the study suggested that the lake would be better ecologically speaking than would the river valley. The Sto-netic model used also indicated the areas of ecological importance. By doing some playing or gaming with the results of the model, one could quantify the impact (both negative and positive) of additional human development after the lake was built. This gaming with the model would yield second generation impact data, quantified in a useful format for evaluation.

In dealing with environmental impact studies, one faces many difficult problems. First among these is the human element. Any study that would attempt to deal with the consequences of a given action on the environment would be remise if it did not include the impact on psycho-social elements. When these factors are not included, we have conducted in essence a benefit-cost analysis and assumed that the benefits are zero.

A need is the ability to incorporate human need and desire data quantitatively with data on other elements. Most generally this is done with only a very simple quantification analysis or with subjective judgment.

There is also a problem of public relations. This occurs not only with private citizens but with professionals. The early mentioned Lake Study is a case in point. Many private citizens, citizen environmental organizations as well as the professionals were against the lake for ecological reasons. The study was made and it suggested that the natural environment and wildlife would be enhanced by the lake.

Another example is the feelings about highway construction. Highway Departments receive a great deal of flak from citizens concerning the damage they do to the environment. I would be the first to admit that damage is done yet the allegations are often from closed minds. The Nebraska Department of Roads for example has received several awards from environmental groups for their conservation work.

The image that people have of highway building is that of a D-9 rolling over deer and rabbits. Thought is not given to the fact that right-of-way along the highways is a prime nesting area for many ground nesting species of birds and that this area is provided only because the road is there. This is again a second generation impact, in this case a positive impact.

A final problem is the lack of quantification that is achieved in environmental studies. Possibly it is the engineer in me but I hold the feeling never-the-less that if the rationalization of the total complex of the environment is to be dealt with the means of rationalization will be quantification and not rhetoric.

The problems of environmental studies offer new challenges to consultants. It has been the function of consulting firms to offer to their clients abilities or staff that the client cannot spare or does not possess. The same function can be performed in carrying out environmental studies. The difference is that environmental studies demand a greater breadth of staff support and a different operating philosophy.

The final point is that we are all, regardless of our job classification, keenly interested in the problem of integrating Man's environment and the natural environment in the most satisfactory manner. The problem before us is not simply to save the environment though it must be saved. The problem is not to manage development though development must be managed. The problem is to preserve the natural environment while at the same time maintaining and increasing the quality of Man's environment for Man.

ENVIRONMENTAL DESIGN

By

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In these days of expressed concern for environmental problems, it is still common to have the usage of the word "environment" limited to a description of natural systems. Indeed there are many who view the environmentalist as a person dedicated exclusively to the preservation of nature, ignoring man. Others imagine the environmentalist as being anti-technology and categorize him as being opposed to progress . . . progress being an ill defined word covering anything that is under consideration or development, be it good or bad; innovative or repetitious.

There may be some environmentalists who prefer nature to people; or others who are totally against technological development; but these are extreme positions and do not represent the vast assembly of people who are appealing for a sane utilization of our natural wealth or the curbing of rampant pollution of the environment. To this vast majority, the objective is a harmony of man and nature to the benefit of both. Within this context the professions identified as 'Environmental Design' strive to create a suitable habitat, reflecting the innate dignity of man.

Perhaps one of the greatest anomalies of contemporary society is that while possessing vast knowledge supported by an incredibly complex technology, we have lost faith in our ability to achieve. How readily we establish restrictive parameters to limit our accomplishments. We tell each other 'that people would never accept it' -- without ever giving people a chance to study the possible alternatives and to express an opinion.

In a sense, this misguided concept of what can be accomplished, thwarts the full utilization of environmental design in the realization of a balance between nature and man. Because he is a designer, we immediately perceive him as a person motivated by an internal force which finds expression in an art form. He is generally judged as not understanding or utilizing science; as being highly theoretical rather than practical . . . he is a person brought in to "beautify" after the real decisions have been made! Society's cosmeticians as it were! Actually many designers are called upon to play the role of community mortician. Just as the funeral director is expected to take a mutilated and lifeless body and make it presentable for public viewing; so the environmental designer is asked to take a dismembered and destroyed landscape and to restore it to some semblance of natural form, for the enjoyment of man.

Failure to place man in nature is the cause of so many mistakes. Through an understanding of the natural systems and a realistic assessment of human needs, it is possible to plan man's works, so that they mitigate environmental insult and, in some instances, enhance a natural situation. But to accomplish this goal it is absolutely essential that the environmental designer be involved at the very beginning of any project. He is least effective when used only to correct the mistakes of engineers or developers.

Perhaps as you read the title of this talk you conjured up a session of 'how to beautify in six easy steps.' If so, I'm sorry to disappoint you. There is no easy formula or paint-by-the -numbers solution to environmental design problems. Oh, I could stand here and deliver a lecture on ways of improving the appearance of an electric transmission line; or how to prevent highway engineers from destroying the human scale or optimum social patterns in our cities. We could discuss fix-up, paint-up, clean-up campaigns, or how to undertake creative restoration projects in spoiled areas. But to do so would be to respond to symptoms--not causes. Today I want to deal with the underlying principles upon which environmental design decisions must be based.

But let us return for a moment to the issue of concern for man and his comforts. Effective solutions to environmental problems require that we structure the natural and man-made systems as an interdependent ecology. Cities, industrial areas, transportation routes and parks are related to and complimented by trees, rivers and wildlife. In totality these are the determinants of the quality of life. Note I refer to a quality of life rather than a standard of living, for in a lunatic pursuit of an elusive standard of living we often degrade the quality of life as well as the environment.

Despite what you may hear to the contrary the environmentalist is concerned about people, is conscious of the innate dignity of man and seeks a higher quality of life for all mankind. In recent months so many speakers have said "Environmentalist place birds and insects above mankind. They want to save this or that species at the expense of human well being . . .

We, on the other hand, are building power plants, damming rivers, filling the marshes to provide services, jobs and convenience for people." Believe me the biologist, hydrologist and all the other 'ologists' are working desperately to preserve and enhance nature so that, in turn, it will continue to support mankind.

If you doubt this proposition, then imagine for a moment that we are the last generation on earth . . . after us nothing! Under this circumstance, beyond our own immediate needs, do you honestly believe that we would demonstrate any real concern for the environment? Would we really fight to preserve marshes and waterways, forests and prairies, birds and fish? I don't think so! Surely, in pursuit of a chosen life style we would use nature for all it is worth, content in the knowledge that our actions would not deprive others of nature's bounty. It is because we are concerned about people, particularly those of future generations, that we caution wise use of natural resources. By not destroying that on which man is dependent, we assert the right to continued human existence. In a pretentious manner some declare that they are 'conquering nature.' How infantile! While we may destroy a portion of the natural systems, the chain reactions started will produce situations which will cause man to become subordinate to nature.

Do not misunderstand me! I'm not thumping the doomsday drum, nor saying that all is lost! On the contrary, my thesis is that through awareness of the dire consequences of irrational actions, we can utilize our knowledge and technology to redress past errors. It is not too late to save the earth, but a terrible price will be exorted for delay in positive action.

Positive action! I support we would claim that the bulk of environmental programs and the majority of Environmental Impact Statements are a positive means of solving our problems. Yet in how many decision-making conclaves is the analytical process looked upon as just another bureaucratic requirement which must be tolerated? Some have already lost sight of the fact that the statements are designed to provide the developer with the opportunity of assessing the impact of the project on man and nature. From this assessment comes the challenge of mitigating any degradation of the environment and the possibility of enhancing our surroudings. Let us be honest, many Environmental Impact Statements are prepared after the facility has been designed and are used, often erroneously, to justify the project. In these cases the analysis is weighted in favor of the solution already reached, and may ignore vital issues.

Let me emphasize that the primary purpose of the Environmental Statements is to appraise the policy makers in the development company of the consequences of their actions. The reviewer in the State or

Federal agency seldom learns anything new from an Environmental Impact Statement. To him it is a check list from which he can determine the extent of consideration given to possible impacts. It is very probable that he will ask "Have you thought of this, or that?" His is not so much a policing action as an expanding of comprehension.

To be effective the statement must be proceeded by a full environmental analysis. Obviously this must be an indepth study of the existing ecology and of all of the possible impacts resulting from the project. From this analysis it may be determined that the works have no significant impact on some natural systems, may degrade others and may enhance yet others.

It is in the manner in which the analysis and statement is written that I find myself in disagreement with the previous speaker who recommended a compact and precise document. So many statements are unutterably dull and often are read in entirety only by the writer! Because we want the statements to be read and understood, they should be captivating, free flowing papers, portraying, in an easily understood and very readable manner, the interactions of complex systems. They should have an appeal for the Chairman and members of the Board, the building manager, chief engineer, power plant manager and on down the line. Frankly I want people to read what is written and to dwell on the implications of the project. This is our only means of creating an understanding and awareness of the impacts of our everyday activities.

In striving for readability, I have been accused of bordering on the poetic and on occasions will quote poetry! But this is done purposely to develop a sense of curiosity, even if the reaction is "My God, this guy is a nut! I must read on to see what else he has to say ..." A heightened sense of awareness will stimulate creative reactions from all those participating in the planning and development process, thereby producing a better design. In retrospect I find that hardened old engineers, (Hello Lou!) have finally discovered a poetry in the engineering of transmission lines... and that power stations do not have to be expressed so brutally as they have been in the past!

From a well prepared environmental analysis it is a simple matter to prepare a meaningful statement. Perhaps I can make the relationship of the environmental analysis to the statement a little more clear by illustrating a man's reaction to a beautiful girl. You perceive the lustre of the hair, the sparkling eyes and sensuous lips; the symmetry of the face, the emphatic curvature in a well proportioned figure, the exquisite legs, the spine tingling voice, her whole deportment and carriage. These evaluations constitute the environmental analysis. The Impact Statement derived from the analysis is but one word "Wow".

One of the disquieting features of the Environmental Impact Statement process is the growing belief that by themselves they will solve the majority of the environmental problems. I must disagree with this evaluation. To me the environmental crisis is analogous to a car careening down hill, virtually out of control . . . disaster lumes ahead. The Environmental Impact Statement is the emergency brake; it will assist in bringing the vehicle under control-but will not remedy the original failure. If the hill is too long, the continued use of the emergency brake will simply cause it to burn out. Similarly total reliance on the Environmental Impact Statement for control of environmental insult may create greater problems than the procedure was intended to solve. While the concept is good, it is very limited in scope and must be transcended by vigorous programs directed at the source of the problems.

By way of illustrating the ineffectiveness of the Environmental Impact Statement let us examine the case of a utility company planning a transmission line to meet anticipated demands. In good spirit and intent, a thorough analysis is made of the land between point of supply and point of delivery. From several alternates, one is selected as causing the least overall environmental impact. The project can be viewed as environmentally acceptable. But the statement, while recognizing the resources and perhaps pollutions committed to generation cannot answer or solve those problems. The company must accept the present state of the generation and transmission art, knowing that 15% of the generated energy is lost in transmission--that is a fantastic waste of resources. If they are very conscientious they could try to convince their customers that they do not need to use as much energy. They may even convince them to reduce consumption to the point where the new transmission line may not be needed. But, because energy wastage is not yet a national concern what would be the result of this effort? Natural gas and oil companies would jump in and offer alternative sources of energy in response to the imagined or created demand--or other electric companies would laugh the original company out of business and offer to bring energy in over their system.

The individual Environmental Impact Statement cannot treat the complex national technological situations. Nor can uncoordinated, single entity programs provide needed research or long term production policies. Much of this work must be accomplished on a national or regional level, in fully coordinated and adequately financed positive action projects. We must recognize that Environmental Impact Statements written for specific projects are very useful but highly limited instrument for solving environmental problems.

What, then, must we do? Having broached the problem of electrical supply let us continue the analysis. For several years we have been bombarded with problems of keeping pace with the demand for electricity.

All sorts of interesting statistics have been bandied around, from the increase to eight or ten times present demand for the year 2000, to the fact that by that year as much energy will be lost in transmission as is being produced today! Dwell on these figures for a moment and then compare them to population growth . . . even the most radical projection indicates a doubling of population in that time period--and there is a possibility that there will be only a very moderate increase over present numbers. Why then should per capita usage of electricity increase so much? What is the "Demand?" Surely this is a word which has been captured by the marketing branches of our business. It is in effect the amount of electricity we can be conned into using by those who measure progress by consumption. It presumes an inexhaustible supply of resources. It certainly does not reflect true needs. Therein lies one solution to the energy crisis! The ability to distinquish between what has been called "demand" and that which is actual need . . . the line which separates utilization from waste.

Tour any downtown area at night and observe the buildings lit up from basement to roof--and occupied by a few janitors. Observe the neon signs displaying to empty streets in the wee hours of the morning. Night time energy comes at a cheaper rate we are told--but it doesn't use any less fuel to generate! We don't have to go too far to find other examples of our excesses. For instance how many of you walked out of your hotel room leaving all the lights burning? How many homes are overheated or over cooled? Stay for a moment on the domestic scene and count up the number of electric appliances which are used without good reason. How many "labor saving" devices have been developed which add little, if anything to the quality of life. We spend hundreds of dollars buying gadgets to save on human effort and hundreds more to devise exercises to tone up the body and prevent heart attacks! Consider the ubiquitous garbage disposal unit and witness the after supper activities in the kitchen. Surplus food is cleaned off the plates into the sink, the water is turned on and then the power. Within moments the food has been conveyed to the sewers! (Incidentally large quantities of fertilizer and pesticides were also used on the crops providing potential sources of pollution). More energy is used in cooking, in treating and pumping the water to the sink and later in cleaning the sewage, yet more energy is used to operate the disposal unit. Why this waste? Charlie tells us "Hell, Mom I've never liked green beans and yet you still give them to me." The resource appears plentiful, the need to conserve is not apparent--so we waste our produce and energy. Why not be more careful in apportioning our supplies. If food is left over, feed it to the dog or use it as garden compost--don't flush it down the sink!

In other areas we use electricity to overcome deficiencies in logical thinking. How many architects have ignored the basic science of heat transfer in the design of buildings? Rather than speak of thermal integrity we simply refer to tons of air conditioning or BUT's of heating. In order to achieve an illusive design effect, west walls are all glass. To overcome heat and glare, great efforts are expended in bronze glass, curtains and air conditioning. Energy, in the form of heating and cooling, is used to overcome inadequate insulation. The buyer saves a few dollars in the original construction cost, only to pay it out many times over in utility bills. Poor design is costly in terms of money and energy--but who cares? Somewhere there will be found a resource to meet the demand! The architect doesn't have to pay the utility bills; the contractors build what is designed; the utility company is glad to sell the energy and will demonstrate yet other ways in which to increase usage. Who cares? Nobody! It has been said that a well designed house would require about one third the present usage of electrical energy. Good design from this standpoint has not been sought and is not welcome.

It is not possible to mention the energy crisis without referring to oil, the product on which the country runs. Here again we need to differentiate between "demand" and "need". Through a complex progression of advertising, ego satisfaction and irrational land use policies we have allowed ourselves to become almost totally dependent on the automobile as our means of transportation. As a consequence, we have produced one of the most expensive and least efficient transportation modes possible. In many areas congestion is the normal traffic condition. Cities have sprawled out into very productive agricultural lands and in their sprawl have destroyed the sense of community. While we speak of overcrowded cities we fail to recognize that as much as one half of the urban area may be given over to highways, parking areas, and other related facilities. Over 60% of air pollution is generated by the automobile. This litany of problems constitutes a fair portion of the urban and environmental crisis. Yet we seldom view them as being related. On the contrary, automobile, concrete and steel lobbies are in Washington asking for more highways, seeking new ways to subsidize the degradation of the environment and the quality of life.

Our approach to solutions has been a major thrust to control automobile emissions. People get excited about the prospect of non-air polluting vehicle and actually see this as a real solution. It is good that we are promulgating standards for emission control. But when we have spent our billions of dollars on anti-pollution devices we will still not have solved the crushing demand for oil, the congestion on our streets, the terrible sprawl of cities over the landscape. Nor the water pollution resulting from rains washing oil, lead, heavy metals and burned rubber into roadside ditches and streams. Surely the problem must be analyzed in totality and solutions sought in alternate modes of individual and mass transportation. We simply cannot guzzle up the world's oil supply in a frenetic splurge of waste.

As an aside to the problem of transportation, we have witnessed a national effort to disassemble the greatest transportation design team. Over a decade we educated and brought together the most brillant men in the world to work on the space program. Then at the peak of performance we redirected our energies to other programs. Instead of using this team to develop superlative systems of mass transit, we scattered them into other areas; "Retreading" them as social workers, accountants and heaven knows what. We failed to recognize that the engineer who designed the nose cone was the man needed to develop guidance systems for transit; the physicist who worked on fuel could direct us into new methods of propulsion. Unfortunately we are wasteful of human as well as natural resources.

One area in which significant results are being achieved is that of water pollution control. There is no question that much has been achieved, even though a great deal must yet be accomplished in cleaning up the waterways. Certainly federal, state and local agencies and private industry have invested billions of dollars in the program. A magnificent effort! But how much of the expenditures are really necessary? How much do we spend to clean water which should not have been polluted in the first instance? Do we associate polluted water with another problem which lies just over the horizon, that of maintaining an adequate fresh water supply. Our per capita use of water has trebled in twenty years. Now it is predicted that in fifteen years we will be unable to meet the national demand from present sources. Anticipating this as a possible problem we have adopted the typical approach of "how can we develop new sources?" Already some have suggested bringing polar ice to locations off shore where it would be melted. Others suggest desaltinization of sea water. We have witnessed the consequences of programs to develop new sources. Rivers are dammed and water is transported hundreds of miles out of natural drainage areas to supply sprawling cities. One basin is denied its natural flow the other gets a surfeit of fresh water, changing the ecology of both and their dependent coastal marsh and estuarine areas. The waters of the Colorado and many other rivers are diverted to supply the monstrous Los Angeles conurbation. Perhaps society would be better served if the water supply to that city were reduced or cut off!

Surely before we seek new resources we must ask "why do we use water in such quantities?" The use of water for the garbage disposal unit has been cited as unnecessary--what are the other ways? When you shaved this morning you probably left the faucet running all the time, occasionally swishing your brush or razor into the stream. Or the ladies may have luxuriated in a bath filled almost to the brim when actually a pint or quart of water would have perfomed the ablution. We flush gallons of water down the comode to remove a small quantity of human waste. Our household machines consume considerable amounts of water not all of which is needed. Extend these considerations into schools, businesses and industries and in each case we can demonstrate fantastic waste of water.

Remember that it takes a great deal of energy to supply, treat, remove and clean water. Additionally huge investments are required to store and transport the resource. If we simply reduce the amount of water wasted we will cut energy and economic costs and prolong the useful period of present supplies. This can be done without any compromise of our quality of life. The next stage is to develop new techniques for accomplishing everyday tasks without the use of water or by using closed systems. Water is not the only means for washing clothes or dishes, nor it it the only way of performing certain manufacturing processes. Here then is the challenge to engineers to discover better ways of doing ordinary jobs without using water. As a point of beginning let us examine what has been acomplished in the space capsules. Then let us divert $100 million for the treatment plant program into needed research. If the engineers in this room can't begin to devise better ways and means of carrying out processes without using water, then they are not entitled to the degree they hold. In time this investment in research will save the nation billions of dollars and safeguard the environment from unimaginable degradation. As long as we classify our waste of water and a "demand" then we cannot criticize the Bureau of Reclamation or the Corps of Engineers for damming up rivers, with all of the attendant changes in the natural systems. It is we who ask them to meet our demands.

The methods of handling water causes me to think of the design of residential subdivisions and to revert to the environmenal designers concern for the quality of life for people. Admittedly, we have devised some machines and gadgets for the home which purport to add to our standard of living, but which in the final analysis don't really improve the quality of life. But what of the design of the subdivision or home? Here we display our talent for janitorial engineering and our ignorance of mans' needs. By formula and regulations, we have developed systems for handling traffic, utilities, and stormwaters. The street is the all important element carefully paved and a full 27 feet wide. We allocate this width for 2 moving lanes of traffic and one parking lane -- yet each house has four or more parking spaces in carports and driveways.

The street is or should be a serviceway to our homes but we treat it as the social artery. Our houses are oriented to the travelled way and invariably we build a great picture window overlooking the street scene. Having achieved the transition of indoor to outdoor space, we sit in the quietude of our living rooms and partake of the beauty of the passing milk truck, delivery van, and garbage truck!

Electric utility poles slash the skyline like accusing fingers tied together by a mesh of memory strings. Rainwater is not allowed to percolate into the earth. Instead, it is rushed by channel and pipe to crest somewhere downstream. There, because of reduced concentration time and increased volume, it scours and erods stream beds and banks -- to be later deposited as unwanted sediment in an estuarine area. Despite our prowess in engineering, we have not developed environmentally acceptable residential areas.

Dismal though these engineer faux pas may seem, their absurdity is heightened when we place man in the context of the subdivision. We are supposedly catering to the needs of all people, but where does one find a place in the residential sector where teenagers can congregate to enjoy a relaxed time? There is no place! We ignore their need for recreational pursuits and treat them as a damned nuisance. If they want to do their thing, let them go somewhere else. But the young married couple fares no better. Blissful in their enjoyment of the romance and beauty of life, they seek open spaces where they can do their thing ....(loud and sustained laughter) ..... what I meant to say is that there are few, if any, places where young people can relax in the passive surroundings of a quiet stream meandering between lofty shade trees, sheltering patches of wildflowers. Those who are in the 'golden years' are also deprived of an enclave where they may withdraw for the bustle of daily life or the arena spaces where they may mix with the young.

After full analysis one is forced to the conclusion that subdivisions are designed for automobile travel, delivery services, garbage collection, street sweepers, and myriad other functions, but not for a full and vital living experience for the residents. Even the house design offers little opportunity for individual expression or the enjoyment of family in community. Poor planning, illogical materials, and inadequate sound barriers produce conflicts, as Charlie tries to tootle his flute and Bill seeks quiet for study. House design is a topic of essential research. If ever there was a need for Environmental Impact Statements, then surely they are required for subdivisions, where man relates most directly to his environment.

The garbage can and collection truck are very important elements in our chosen life style and, in essence, they symbolize mans penchant for destruction. Statistics on solid waste confound the brain. The quantities are so great that we find it difficult to relate them to normal everyday activities. Yet it is the accumulation of small items which amasses the gargantuan volumes. It is to our shame that much of the production of solid waste exerts the greatest stresses on the environment and contributes least to the quality of life.

Illustrating this point, my favorite item is this package of razor blades. The blades are held in a plastic pack, which is contained in a plastic holder, attached to a fairly substantial piece of cardboard, on which there is a picture of a dragoon going into battle. How come the innocent little pack of razor blades came to be dressed in such an elaborate packaging?

Probably it started on Madison Avenue, when a person wondered how his client could sell more cardboard. "Ah" he said, "if only we could attach razor blades to a piece of cardboard it would make the product more visible and perhaps even less susceptible to shop lifting." Because of the crystallization of the brainwave, at this moment loggers are cutting down trees in Louisiana, Arkansas, Wisconsin, and Oregon. Incredible quantities of steel, copper, oil and other finite resources are committed to the job of cutting, hauling, processing, and manufacturing the timber into cardboard. With each phase there are concomitant pollutions of land, water, and air. Elsewhere oil is being pumped, transported and processed to produce the plastics. Finally, the blades, plastic and cardboard are conjoined into this package. But we're not through! The packages are bigger . . . so that means larger containers to hold them. More trees must be cut and processed, more trucks and railroad cars are required to convey them to distribution points where larger warehouses are needed. Even the supermarket storage areas and shelves have to be increased in size to hold the larger package!

The climax approaches. You ask your wife to buy the blades and gratefully you receive them in your hands. What is the first thing you do? Tear off the package and throw it in the waste basket!!! The cardboard and plastic did not add to the quality of the blades, they did not prevent nicks and scratches of the chin, or overcome the five o'clock shadow. Nor did they make you irresistibly alluring to women. They did absolutely nothing for you!

Now that you are the proud owner of the package, you pay the city to haul it off and bury it in a sanitary landfill, where at least it is out of sight. But even in this its last journey, there are further commitments of energy and other finite resources. Think of all the environmental insults produced in bringing you this and other totally useless packagings. Consider the aluminum cans, the paper bags, the styrofoam, the boxes which end up in your garbage can. Calculate the energy, manpower, and natural resources used to sell you this useless product. Yes there's the ringer--you paid for the useless articles! The foresters, truckers, mill and factory workers did not donate their labor to Wilkinson or Gillette blade users. They were all paid, as were the warehouse and supermarket owners. Those costs were added to the price of the blades. When you paid the $1.98 for the pack, it is possible that 40¢ of that amount was for the packaging!

Imagine, if you will, a supermarket sale where the package alone -- without blades -- is displayed and priced at 40¢. If you saw people buying them you would say they were not right. Yet that is, in effect, what we do when we purchase the blades with the package. By supporting this type of merchandizing, not only do we rape the environment, but we also support a system of private enterprise welfare. We might just as well employ all of these people to dig holes one day and fill them in the next. At least in this pursuit they would cause less harm. Many will say the production is good because it keeps people employed and benefits the economy. In good conscience how can we support such a contention, when with reordered priorities, this work force could be gainfully employed in producing decent housing for the 22 million citizens condemned to live in slums. Or perhaps, they could be building parks or improving education - all those things which the community needs and we tell ourselves we can't afford.

It is important to remember that we do pay for this waste production. Already, voices are raised about the high cost of pollution control. Some ask 'can we afford it?' For years we have heavily subsidized pollution in the form of higher food prices, additional health costs, and in being forced to pay for useless packaging. With redirected national priorities not only can we pay for pollution control, but as a result, enjoy a better life quality. Even more important by conserving natural resources -- that is, not wasting them -- we will reduce the alarming drain of finite materials thereby averting or at least delaying impending crises. At the same time we will also reduce the magnitude of environmental degradation. Ironically, many of those who cry out against the high cost of pollution control are those engaged in manufacturing wasteful products.

This, then, is the challenge. Never in the history of man has the engineering profession had such a great opportunity to serve man and save nature. This is the time when you as professionals must speak out. You must ask for the money to undertake research on vital and basic problems. Do we have the right to consume oil, aluminum, and iron in wasteful practices? Why do we use so much water or why cover the landscape with ill planned and poorly designed buildings?

Much of the information we need for positive environmental actions already exists, we simply have not utilized it. To do so requires that we communicate with other professions, joining with them in a united effort to reach a common objective. In this respect the burden of coordination lies heavily on the Universities. Unfortunately, few universities encourage communications between disciplines. Higher education long ago sold its soul in the commercial market place. It is past time for them to return to the search for basic truths. The environmental crises will not be solved by a frenzed quixotical pursuit of extravagant cosmetic treatment of symptoms. Honest search by dedicated people, working as a team, will open the paths to success.

When you came to this lunch, I doubt you expected this sort of talk. Having heard it, I hope it creates a new awareness. Do realize that the Environmental Impact Statement process, of itself, is not the beginning of paradise. At best it may only be a way of pointing out the frustration of accomplishing desired objectives in small scale projects, when the real solution lies in dynamic national goals.